NAVSHIPS 91630

INSTRUCTION BOOK

for

FACSIMILE RECORDER RD-92A/UX

TIMES FACSIMILE CORP.
NEW YORK, N. Y.

BUREAU OF SHIPS NAVY DEPARTMENT

Contract: NObsr-52050 *Approved by BuShips: 6 November 1952*

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NEW YORK, N. Y.

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USAF

ADDENDUM TO NAVSHIPS 91630 MANUAL

RD-92( )/UX IS THE NAVY DESIGNATION FOR THE TIMES FACSIMILE CORPORATION RG FACSIMILE RECORDER.

THE RD-92/UX IS EQUIVALENT TO 300 AND 400 SERIES RG RECORDERS. 500 SERIES RG'S ARE EQUIVALENT TO THE RD-92A/UX EXCEPT THE RG HAS NO DRUM SHIELD ASSEMBLY OR NOISE SUPPRESSION FILTER Z2.

IN 500 SERIES RG AND RD-92/UX RECORDERS, THE PILOT LAMP IS CONNECTED BETWEEN ONE SIDE OF POWER LINE AND GROUND. IN RD-92A/UX RECORDERS, THE PILOT LAMP IS CONNECTED ACROSS THE LINE.

ADDITIONAL COMMENTS ON COMMERCIAL MODELS OF THE RG RECORDER:

100 SERIES: PERMITS MANUAL (LOCAL) OPERATION ONLY. USE 100 SERIES SCHEMATIC FOR SERVICING.

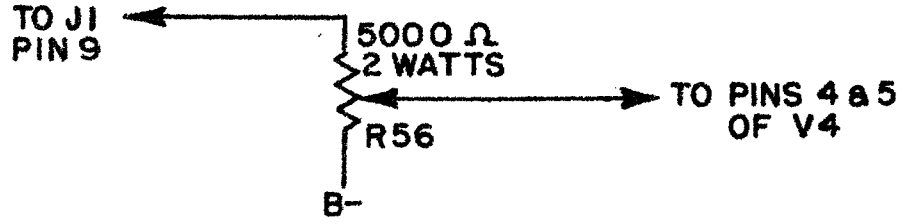
200 SERIES: SHOULD BE USED FOR MANUAL OPERATION ONLY. CONTAINS OBSOLETE CIRCUITS FOR AUTOMATIC (REMOTE) OPERATION. THEY WILL NOT INTERFERE WITH MANUAL OPERATION IF THE RELAY ON THE PHASING SWITCH IS TIED DOWN OR IF THE PHASING BUTTON IS IN LOCAL POSITION. USE A 200 SERIES SCHEMATIC FOR SERVICING.

200A SERIES: A MODERNIZED 200 SERIES MODEL. CONTAINS REVISED AUTOMATIC CIRCUITS. EQUIVALENT TO 300 SERIES EXCEPT DOES NOT INCLUDE WIRING TO J6 FOR USE WITH CONTINUOUS RECORDERS. CAN BE USED FOR AUTOMATIC OPERATION. USE SCHEMATIC IN RD-92A/UX MANUAL FOR SERVICING.

300, 400 & 500 SERIES: CAN BE USED FOR MANUAL (LOCAL) OR AUTOMATIC (REMOTE) OPERATION. CONTAINS PROVISIONS FOR USE WITH CONTINUOUS RECORDERS. USE SCHEMATIC IN RD-92A/UX MANUAL FOR SERVICING.

MECHANICAL UNITS: ALL MECH UNITS RECEIVED FROM TFC WILL BE MODERNIZED TO PERMIT USE IN ANY OF ABOVE SERIES ELECTRICAL UNITS.

ALL RG'S EXCEPT THE 100 SERIES WILL EVENTUALLY CONTAIN A POTENTIOMETER BEHIND THE LEFT HAND GEAR BOX. THIS CONTROL SHOULD BE ADJUSTED ONLY WHEN THE RECORDING DENSITY OBTAINED BY "PEAKING" THE DENSITY" CONTROL IS NOT SATISFACTORY. TO ADJUST, PEAK THE DENSITY CONTROL ON PHASING SIGNALS AND SET THE ABOVE POTENTIOMETER FOR SUITABLE RECORDING. SEE SCHEMATIC BELOW.



DEPARTMENT OF THE NAVY
BUREAU OF SHIPS
WASHINGTON 25, D. C.

IN REPLY REFER TO
Code 993-100

6 November 1952

From: Chief, Bureau of Ships
To: All Activities Concerned with the Installation, Operation and Maintenance of the Subject Equipment

Subj: Instruction Book for Facsimile Recorder RD-92A/UX, NAVSHIPS 91630

1. This is the instruction book for the subject equipment and is in effect upon receipt.

2. When superseded by a later edition, this publication shall be destroyed.

3. Extracts from this publication may be made to facilitate the preparation of other Department of Defense Publications.

4. All Navy requests for NAVSHIPS Electronics publications should be directed to the nearest District Publications and Printing Office. When changes or revised books are distributed, notice will be included in the BuShips ELECTRON and in the Index of Bureau of Ships General and Electronics Publications, NAVSHIPS 250-020.

H. N. WALLIN
Chief of Bureau

RECORD OF CORRECTIONS MADE

CHANGE NO.	DATE	SIGNATURE OF OFFICER MAKING CORRECTION

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SAFETY NOTICE

The attention of officers and operating personnel is directed to Chapter 67 of the *Bureau of Ships Manual* or superseding instructions on the subject of radio-safety precautions to be observed.

This equipment employs voltages which are dangerous and may be fatal if contacted by operating personnel. Voltages as high as 1,000 volts, 1800 cycles alternating current may be developed in the motor amplifier circuit of Facsimile Recorder RD–92A/UX. Voltages as high as 350 volts direct current are developed in the RD–92A/UX recorder. Extreme caution should be exercised when working with the equipment. Make sure that the equipment is well grounded.

While every practicable safety precaution has been incorporated in this equipment, the following rules must be strictly observed:

KEEP AWAY FROM LIVE CIRCUITS:

Operating personnel must at all time observe all safety regulations. Do not change tubes or make adjustments inside equipment with high voltage supply on. Keep one hand in your pocket while making high voltage measurements. This precaution will help prevent touching the electrical circuit with more than one part of the body at one time. To avoid casualties always remove power and discharge and ground circuits prior to touching them.

NEVER MEASURE POTENTIALS IN EXCESS OF 1,000 VOLTS BY MEANS OF FLEXIBLE TEST LEADS OR PROBES.

RESUSCITATION

AN APPROVED POSTER ILLUSTRATING THE RULES FOR RESUSCITATION BY THE PRONE PRESSURE METHOD SHALL BE PROMINENTLY DISPLAYED IN EACH RADIO, RADAR, OR SONAR ENCLOSURE. POSTERS MAY BE OBTAINED UPON REQUEST TO THE BUREAU OF MEDICINE AND SURGERY.

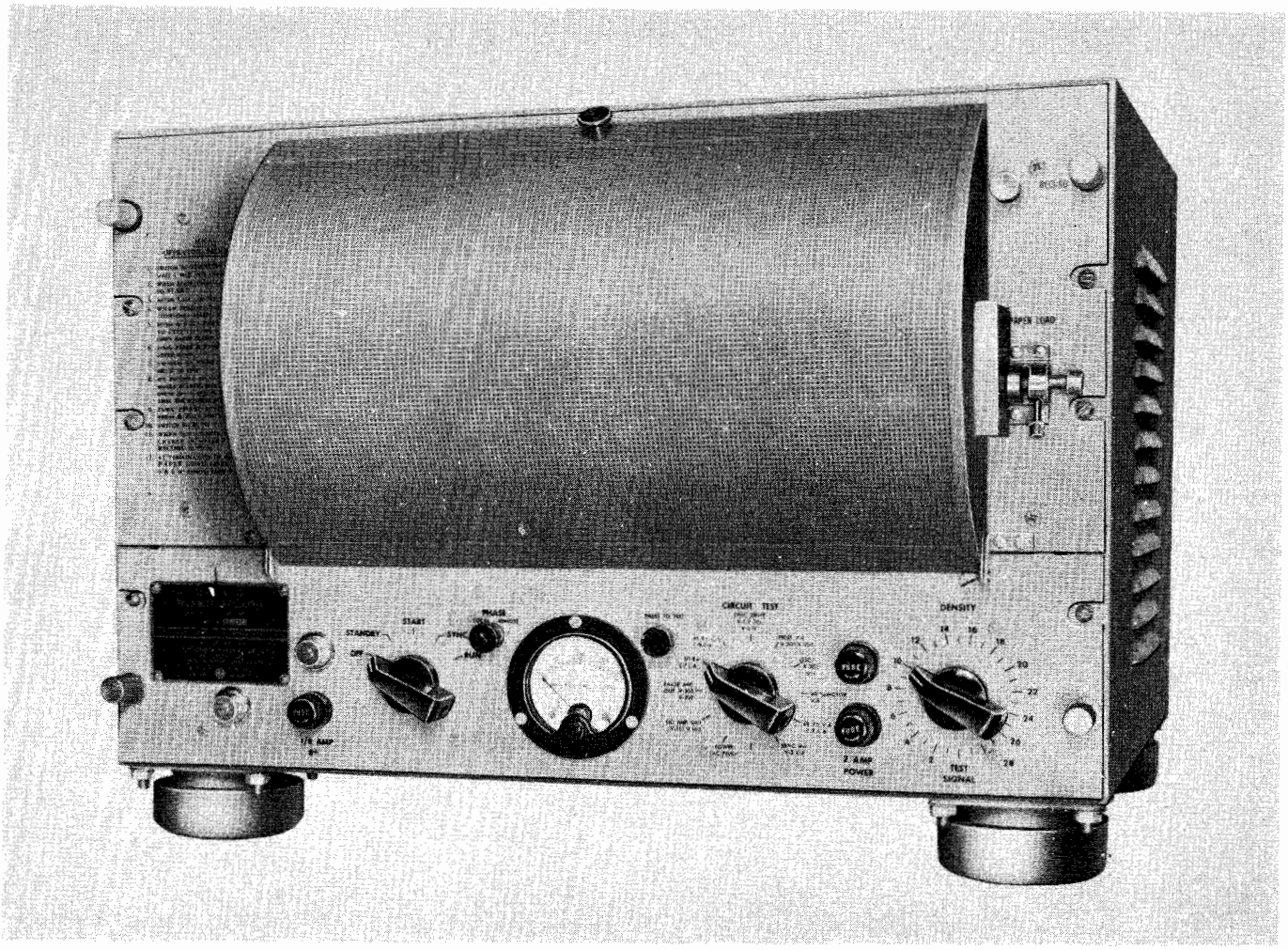


Figure 1–1. Facsimile Recorder RD–92A/UX

SECTION 1
GENERAL DESCRIPTION

1. INTRODUCTION.

This instruction book covers the essential information for installation, operation, and maintenance of Facsimile Recorder RD–92A/UX. It is a revision and extension of material covered in NAVSHIPS 91401, Instruction Book for Facsimile Recorder RD–92/UX. Auxiliary equipment, not supplied, which may be used with this equipment are: Frequency Shift Converter CV–172( )/U and Automatic Start and Transfer Unit, Times Facsimile Model AST–( ). The Automatic Start and Transfer Unit is commercial equipment not purchased by the Navy Department at present. Full details as to its application, installation and operation will accompany the unit when it is procured.

2. PURPOSE AND BASIC PRINCIPLES.

a. PURPOSE.—Facsimile equipment is used to transmit fixed images over an electrical communication system, such as wire or radio telephone circuits. These images may be pictures, maps, sketches, typewritten and printed text, or handwriting.

b. BASIC PRINCIPLES.—A facsimile system consists of a facsimile transmitter and a facsimile recorder. The facsimile transmitter resolves a sheet of copy to be transmitted into elemental areas, develops electrical signals corresponding to each elemental area in sequence, and transmits these signals for reception by the facsimile recorder. The facsimile recorder accepts and amplifies the facsimile signals and converts them back into corresponding density variations on a recording sheet.

c. GENERAL DESCRIPTION OF FACSIMILE RECORDER RD–92A/UX.—Facsimile Recorder RD–92A/UX, figure 1–1, makes direct recordings of copy transmitted from a Facsimile Transceiver, TT–41( )/TXC–1B, or equipment having the same transmission characteristics. The facsimile recorder is a self-contained unit mounted on a standard relay rack panel 12¼ inches high. The recorder may be installed in a 19-inch rack with rollers which permit it to be pulled in and out as a file cabinet drawer, enabling easy operation and rapid servicing.

The unit consists of an amplifier-power supply chassis and four plug-in subassemblies. These subassemblies are: audio-frequency oscillator, marked FORK AMP; amplifier-detector, marked SIG AMP; amplifier-modulator, marked REMODULATOR; and the recorder subassembly.

A test switch mounted on the front panel provides means for quickly testing all important circuits. Neon light indicators across individual fuses and tube heaters instantly indicate a blown fuse or burned out tube heater.

d. APPLICATIONS OF FACSIMILE RECORDER.—Facsimile Recorder RD–92A/UX is used for recording facsimile signals from either wire or radio communications circuits.

(1) WIRE CIRCUITS.—When used with wire lines, the recorder is connected directly to the line. No external coupling transformer is required.

(2) RADIO CIRCUITS.—When used to record facsimile signals from radio circuits, the auxiliary equipment required is determined by the type of modulation used. This may be amplitude modulation (AM), audio-frequency shift modulation (AFS), or radio carrier frequency shift modulation (RFS).

(*a*) AMPLITUDE MODULATION.—When receiving amplitude modulation, the 500-ohm output of the radio receiver is connected directly to the INPUT terminals of the facsimile recorder. If the radio receiver has no 500-ohm output, use the lowest output impedance available.

(*b*) AUDIO-FREQUENCY SHIFT MODULATION.—When receiving AFS, the 500-ohm output of the radio receiver is connected to the INPUT terminals of the auxiliary equipment, Frequency Shift Converter CV–172( )/U. The output from the converter is connected to the input terminals of the facsimile recorder.

(*c*) RADIO CARRIER FREQUENCY SHIFT MODULATION.—When receiving RFS, Frequency Shift Converter CV–172( )/U is used. Additional auxiliary equipment may be required.

(3) AUTOMATIC PHASING AND STARTING.—Auxiliary equipment, Automatic Start and Transfer Unit, Times Facsimile Model AST–( ), when used in a facsimile installation, enables unattended automatic phasing and starting, with the operator merely unloading received copy and putting in fresh paper. This auxiliary equipment may be used for recorder installations operating from automatic phasing and start

signals sent by the facsimile transmitter. With two facsimile recorders, it is possible to provide 40 minutes of continuous unattended operation of the recorders. At the end of one transmission, the auxiliary equipment transfers the signal to the second recorder, which is automatically phased and started on the succeeding transmission. The operator need not be present at the beginning of the transmission. He merely unloads received copy and puts in fresh paper whenever convenient in 25 to 40 minute intervals.

3. DESCRIPTION OF UNITS.

While Facsimile Recorder RD–92A/UX is a complete unit in itself, it is made up of a number of plug-in subassemblies, each providing specific functions. The locations of these subassemblies is shown in figure 1–2. The individual assemblies are: the recorder subassembly, figure 1–3; the amplifier-detector, figure 1–4; the amplifier-modulator, figure 1–5; the audio-frequency oscillator, figure 1–6; and the amplifier-power supply, figure 1–7, which serves as the basic chassis on which the four subassemblies are plugged-in.

a. RECORDER SUBASSEMBLY.—Facsimile Recorder RD–92A/UX performs its function of recording pictures, drawings, or messages by rotating a drum at a constant speed, while feeding a stylus needle along the drum, one scanning line for each revolution, until the complete drum has been covered. This function is

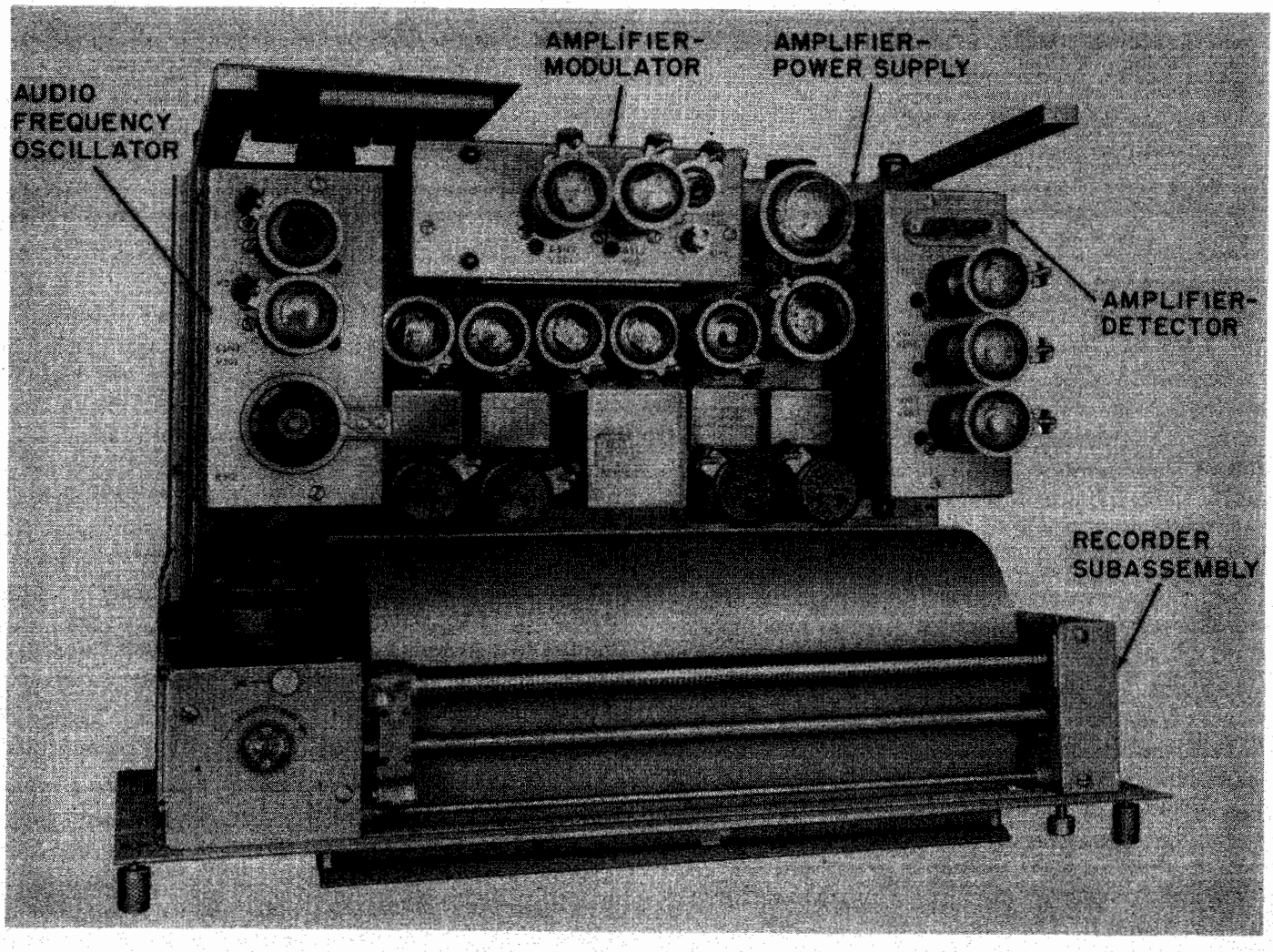


Figure 1–2. Location of Subassemblies

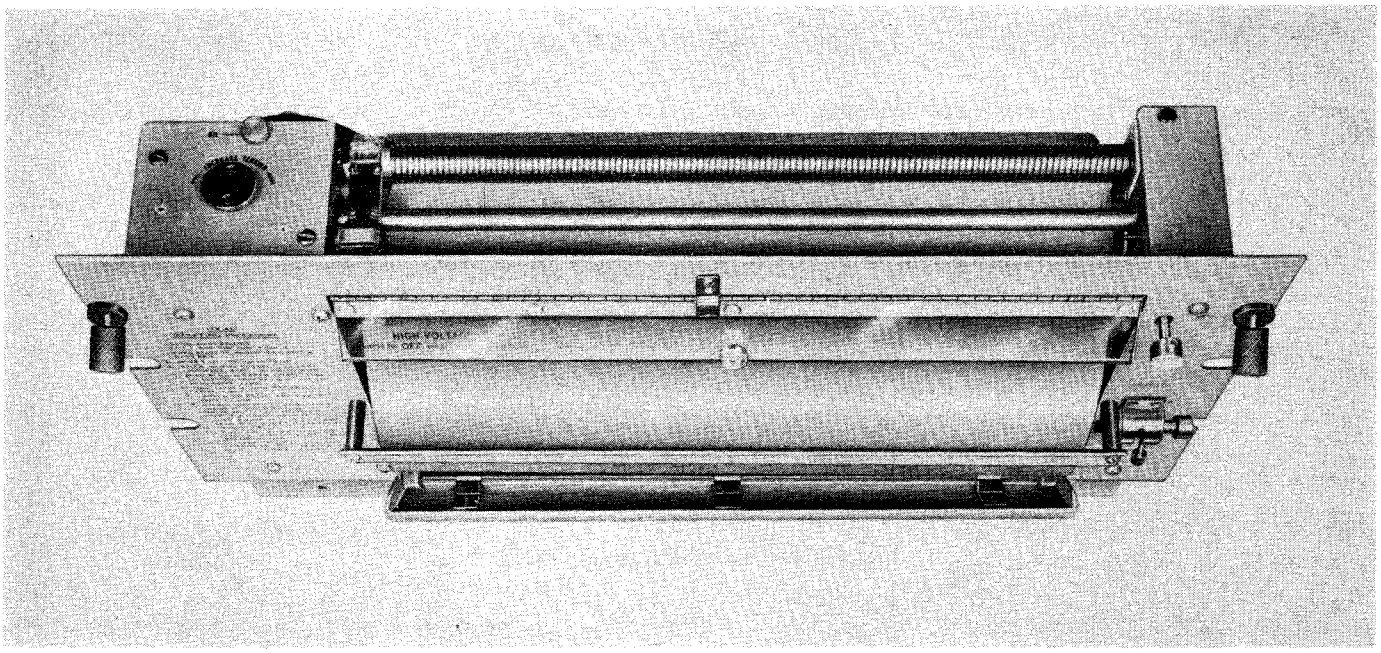


Figure 1–3. Recorder Subassembly

performed by means of three motors and suitable gears and mechanical linkages contained within the recorder subassembly. The power, signal, and phasing currents for proper operation of the recording mechanism are obtained from the outputs of the electronic subassemblies.

b. AMPLIFIER - DETECTOR.—The amplifier-detector unit, mounted at the right side of the recorder, receives the input facsimile signal. It consists of the complete signal amplifier and the rectifiers of the demodulator unit, in addition to an amplifier for the meter test circuit.

c. AMPLIFIER - MODULATOR. — The amplifier-modulator unit, located at the rear of the recorder, contains a 15 kc oscillator, a modulator, a driver amplifier, and the electrical portion of the phasing circuit.

d. AUDIO-FREQUENCY OSCILLATOR. — The audio-frequency oscillator, located on the left side of the recorder, contains a tuning fork and electronic amplifier which provides an 1,800-cycle signal for the motor amplifier and TEST SIGNAL circuits in the amplifier-power supply assembly.

e. AMPLIFIER-POWER SUPPLY.—The amplifier-power supply assembly contains the power supply circuits, print amplifier, motor driver, power amplifier, and various metering and switching circuits. Operating, indicating, and testing controls are mounted on the panel on the front of this assembly. A tool rack is mounted at the rear.

f. CONTROL PANEL.—The control panel at the front of the amplifier-power supply chassis contains the following controls, in order from left to right:

(1) PILOT LAMP.—Indicates when the equipment is turned on.

(2) ONE EIGHTH AMP B+ FUSE.—Protects the high voltage circuits for the motor, print, and phasing amplifiers. The neon lamp directly above this fuse indicates when the fuse is blown.

(3) SELECTOR SWITCH.—Provides the circuit connections to start and operate the recorder. The five positions of the selector switch are:

(*a*) OFF.—Opens one side of the a-c line to turn off the recorder.

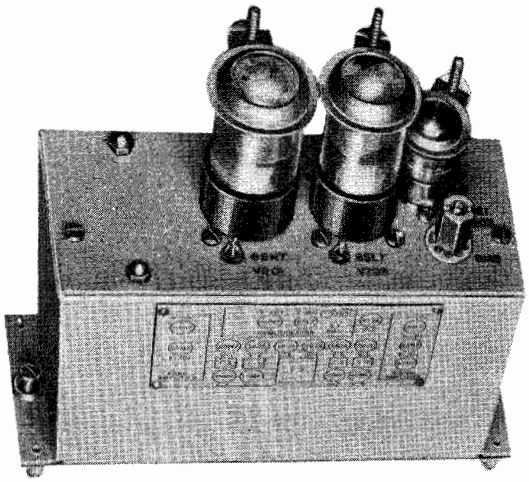


Figure 1–4.
Amplifier-Detector Subassembly

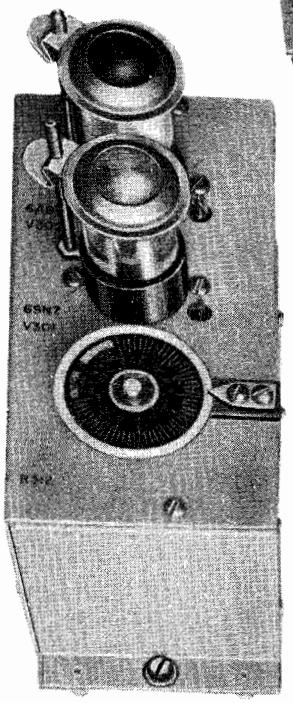


Figure 1–6.
Audio Frequency Oscillator Subassembly

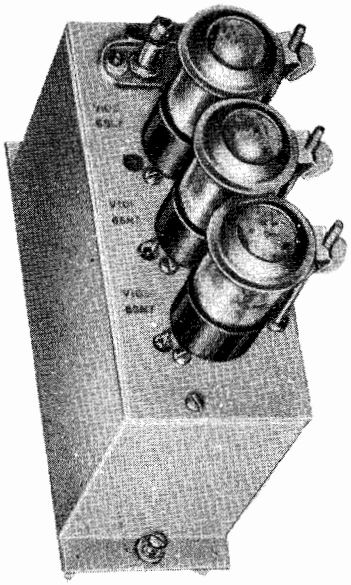


Figure 1–5.
Amplifier-Modulator Subassembly

(*b*) STANDBY.—Turns on heaters of all tubes.

(*c*) START.—Connects a-c power to the start motor and applies plate voltage to the fork controlled audio-frequency oscillator and signal amplifier circuits. The start motor brings the synchronous motor above synchronous speed.

(*d*) SYNC.—Reduces and regulates current to start motor, and applies 1,800-cycle power to the synchronous motor. Applies plate voltage to all circuits. The synchronous motor speed coasts down and locks into synchronism, while the drum remains stationary.

(*e*) RUN.—Switches a-c power from start motor to run motor, which turns the drum and drives it against the stop bar rotated by the synchronous motor.

(4) PHASE SWITCH.—Located just above the selector switch RUN position, the two positions of the switch are:

(*a*) LOCAL.—The PHASE switch is normally left in this position. When phasing pulses are being received, the operator presses the PHASE switch to actuate circuits which set the drum synchronizing mechanism in step with the phasing pulses.

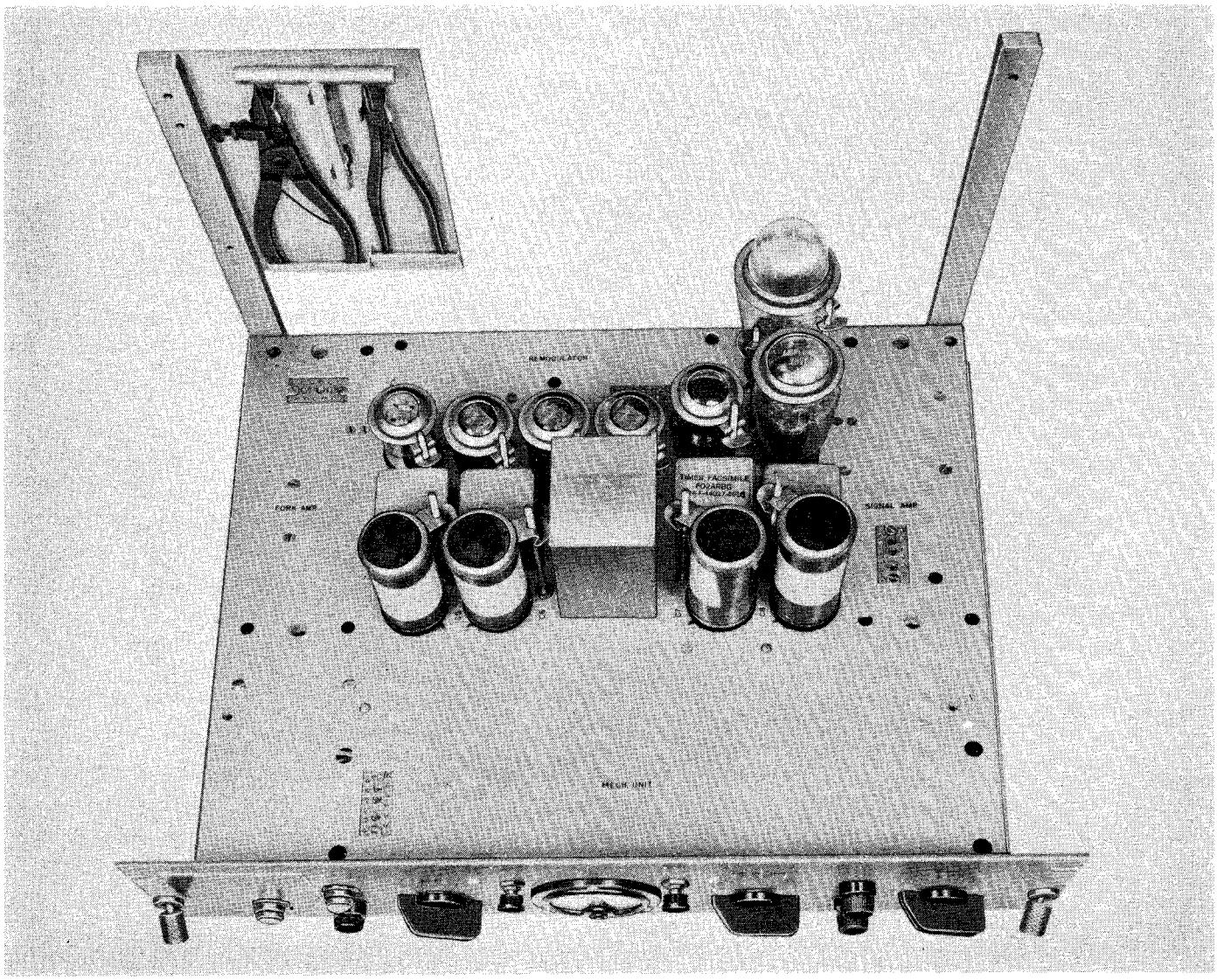


Figure 1–7. Amplifier-Power Supply Chassis

(*b*) REMOTE.—This position is used only with auxiliary equipment, Automatic Start and Transfer Unit AST–( ), in an installation requiring a facsimile transmitter that transmits a *start* signal. When the AST–( ) unit is not connected, the PHASE switch operates the same in either LOCAL or REMOTE position.

(5) METER.—The meter located in the center of the control panel is a 0–1 ma meter with a scale calibrated 0 to 200. The meter connects to a bridge rectifier circuit so that it can measure either d-c or a-c input voltages. The meter is normally connected to serve as an indicator for adjusting the DENSITY CONTROL.

(6) PRESS TO TEST SWITCH.—This switch is used only in connection with the meter and the CIRCUIT TEST switch as a means for quickly locating circuit trouble.

(7) CIRCUIT TEST SWITCH.—This switch enables a quick circuit check when trouble is encountered. The pointer is rotated to the circuit to be tested and the PRESS TO TEST switch is depressed to obtain the test reading. With the synchronous motor running in SYNC position and the DENSITY control in TEST SIGNAL position, the normal meter reading is 100 on the 0 to

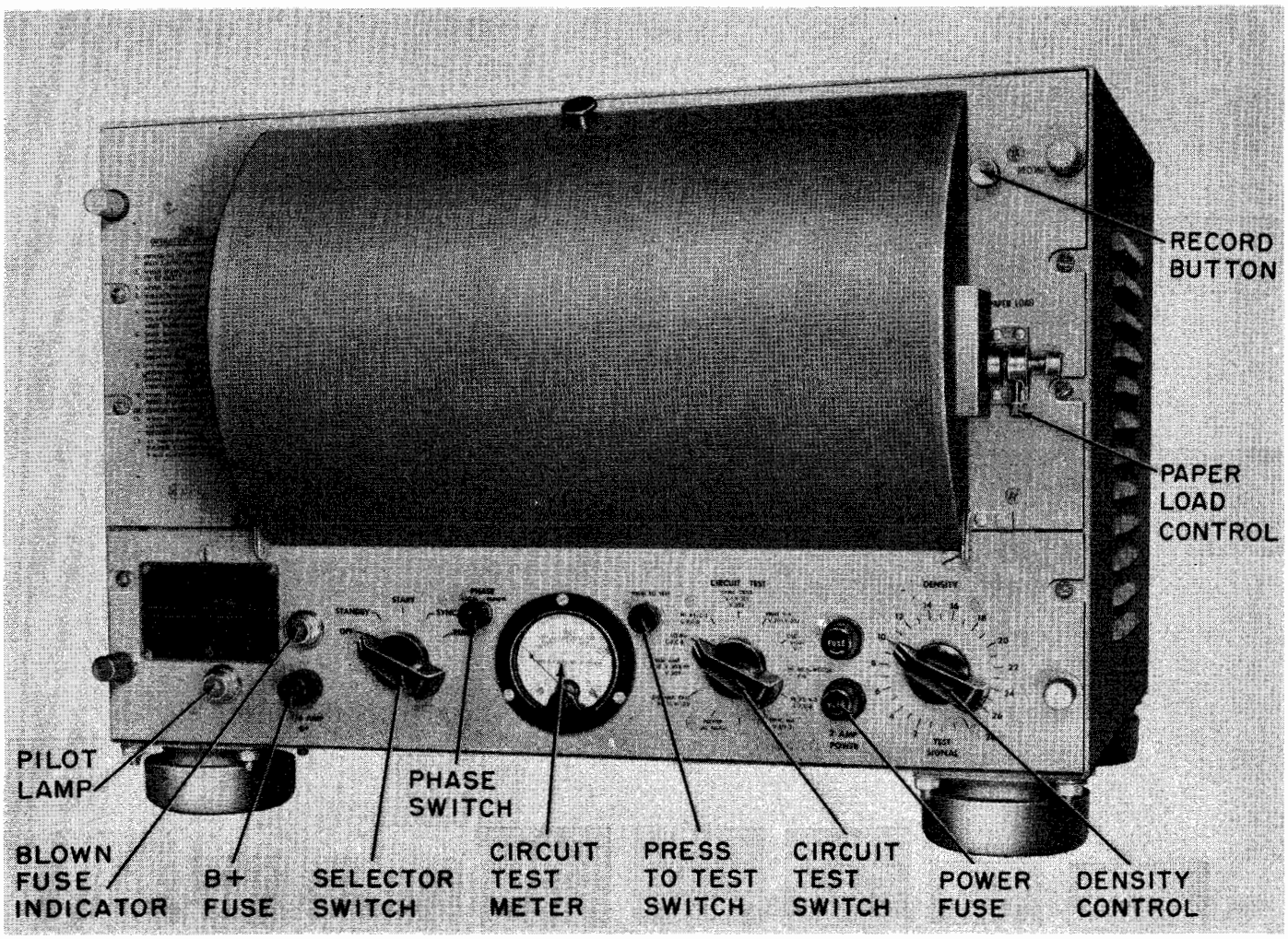


Figure 1–8. Identification of Front Panel Controls

200 scale for all positions of the switch except PHASE AMP and PRINT. The circuit test positions are:

(*a*) POWER
(*b*) SIG AMP OUT
(*c*) PHASE AMP OUT
(*d*) LO B+
(*e*) HI B+
(*f*) SYNC DRIVE
(*g*) PRINT
(*h*) OSC
(*i*) 60-CYCLE MOTOR
(*j*) VR75
(*k*) SYNC MA

The interpretation of the test readings is explained in Section 2.

(8) TWO AMP POWER FUSES.—These fuses are connected in the input power lines for protection of the facsimile recorder.

(9) DENSITY CONTROL.—This control serves to adjust the print circuit, utilizing the meter as indicator.

(10) TEST SIGNAL.—The bottom position of the DENSITY control is labelled TEST SIGNAL. In this position, a signal is fed from the audio-frequency oscillator to the input of the signal amplifier for testing the various circuits with the CIRCUIT TEST switch, when no signal is available from the line.

g. CONTROLS ON RECORDER SUBASSEMBLY.—On the right side of the recorder subassembly are located two additional controls. These are:

(1) RECORD BUTTON.—This button, located at the upper right side of the recorder, starts recording when it is depressed. It releases automatically at the end of travel of the stylus carriage.

(2) PAPER LOAD.—This control serves to stop the drum and open the clamping fingers for loading or unloading the recording paper.

4. DESCRIPTION OF AUXILIARY EQUIPMENT.

a. FREQUENCY SHIFT CONVERTER CV–172 ( )/U.—This unit converts 1,500 to 2,300 cps facsimile signals received from a radio circuit to AM signals for the RD–92A/UX facsimile recorder. The unit contains provision for audible monitoring of the incoming signal and for visual checking of frequency limits. The facsimile signal obtained from the radio receiver is fed through an amplifier to a limiter and then through a frequency discriminator. The output of the amplifier is controlled by an INPUT LEVEL potentiometer to adjust the signal level fed to the limiter. A loudspeaker, with a separate volume control, connects to the output of the line amplifier. This output also feeds two tuned circuits, resonated at 1,500 and 2,300 cycles respectively, to operate a *tuning eye* frequency indicator.

Frequency Shift Converter CV–172( )/U is used at the receiving terminal of a radio facsimile circuit of the AFS or RFS type. The signal from the radio receiver is an audio-frequency shift signal in which 1,500 cycles represents black and 2,300 cycles represents white for the RD–92A/UX recorder. The frequency shift converter converts this signal from the radio receiver into one that may be used by the facsimile recorder.

b. AUTOMATIC START AND TRANSFER UNIT, TIMES FACSIMILE MODEL AST–( ).—This unit is used on recorder installations operating from automatic phasing and start signals sent by the facsimile transmitter for remote control of phasing and starting the RD–92A/UX recorder. The PHASE switch on the recorders must be in the REMOTE position. Normally two recorders are operated by a single AST–( ) unit, with the operator's attention required only at 25 to 40 minute intervals to unload received copy and load fresh paper.

The AST–( ) unit provides a holding current which is electronically controlled so that after approximately three phasing pulses are received at the start of a facsimile transmission, one of the recorders is permitted to phase in the normal manner. Immediately following the last phasing pulse, the facsimile transmitter sends a 60-cycle modulated 1,800-cycle tone, *start signal,* which actuates relays to begin printing the facsimile copy.

At the end of one transmission the AST–( ) unit automatically stops the recording operation and transfers the signal circuit to the second recorder.

The AST–( ) unit contains a monitor amplifier and speaker, so that voice announcements and facsimile signals on the incoming line may be heard. A volume control on the monitor amplifier has no effect on the automatic operation of the recorders.

The AST–( ) unit may be mounted on a standard relay rack using a panel 5¾ inches high. It may also be mounted between two RD–92A/UX recorders which are in their cabinets, by using special side plates provided with the unit. The AST–( ) unit has its own self-contained power supply and operates from a 115-volt, 60-cycle a-c power line. It has two interconnecting cables which fasten to the rear of the RD–92A/UX recorders.

5. REFERENCE DATA.

Facsimile Recorder RD–92A/UX

Contract: NObsr–52050, 18 October 1950

Times Facsimile Corp., New York, N. Y.

Cognizant Naval Inspector:
Inspector of Naval Material
New York, N. Y.

Number of packages per complete shipment of equipment, including equipment spares	3
Total cubical contents, including equipment spares:	
Crated	10.4 cu. ft.
Uncrated	3.2 cu ft.
Total weight, including equipment spares:	
Crated	280 lbs.
Uncrated	175 lbs.
Type of recording mechanism	Rotating drum
Over-all size with cabinet	14½ x 20 x 16½ in.
Weight—rack mounting	50 lb
Weight—with cabinet	71 lb
Recording sheet size	12 by 19⅛ in.
Maximum received copy size	12 by 18¾ in.
Index of cooperation	576 (International index)
Type of recording	Direct stylus
Drum speed	60 rpm
Drum speed control	Synchronous motor controlled by 1,800 cps fork oscillator
Number of tubes	15
Type of modulation	AM
Input frequency	500 to 10,000 cps
Signal level	0 to minus 40 dbm
Input impedance	2,000 ohm
Black to white signal contrast	Adjustable from 10 db to 20 db
Power source	90 to 130 V, 55 to 65 cps ac
Power consumption	150 W at 117 V
Heat dissipation	150 W

6. EQUIPMENT LISTS.

TABLE 1–1. EQUIPMENT SUPPLIED

QUANTITY PER EQUIPMENT	NAME OF UNIT	NAVY TYPE DESIGNATION	OVER-ALL DIMENSIONS			VOLUME CU. FT.	WEIGHT
			HEIGHT	WIDTH	DEPTH		
1	Facsimile Recorder	RD–92A/UX	14 in.	19⅛ in.	17-21/32 in.	2.7	75 lb.

TABLE 1–2. EQUIPMENT REQUIRED BUT NOT SUPPLIED

QUANTITY PER EQUIPMENT	NAME OF UNIT	NAVY TYPE DESIGNATION	REQUIRED USE	REQUIRED CHARACTERISTICS
1	Power source		For operation of RD–92A/UX.	Single phase 115 v, 60 cps.
1	Frequency Shift Converter	CV–172( )/U	For radio operation of RD–92A/UX.	Give required output and contrast level for operation of RD–92A/UX.
1	Automatic Start and Transfer Unit	Commercial equipment. Not procured by Navy at present.	For automatic phasing and starting of RD-92A/UX.	Give necessary control signals for phasing and starting of RD–92A/UX.

TABLE 1–3. SHIPPING DATA

SHIPPING BOX NO.	CONTENTS		OVER-ALL DIMENSIONS			VOL.	WEIGHT
	NAME	DESIGNATION	HEIGHT	WIDTH	DEPTH		
1	Facsimile Recorder	RD–92A/UX	26 in.	19 in.	22 in.	6.3 cu. ft.	140 lbs.
	Instruction Book (2)	NAVSHIPS 91630					
	⅛ amp fuses (5)						
	Stylii (100)						
2	Recording paper (10 pg.)	TIMEFAX ND	23½ in.	26 in.	9½ in.	3.4 cu. ft.	100 lbs.
3	Equip. spares (1 set)		16 in.	10½ in.	7½ in.	.7 cu. ft.	40 lbs.

7. DIFFERENCES BETWEEN RD–92/UX AND RD–92A/UX RECORDERS.

Fundamentally, there is very little difference between the RD–92/UX and the RD–92A/UX facsimile recorders. The controls of the two equipments are physically located in identical positions and function in the same manner.

The major differences are indicated in Table 1–4.

TABLE 1–4. BASIC DIFFERENCES RD–92/UX and RD–92A/UX FACSIMILE RECORDERS

ITEM	RD–92/UX	RD–92A/UX
R-f interference reduction	Stylus guard door made of copper laminate to shield arc.	*a.* Noise suppression filter in power line to reduce conducted noise interference. *b.* Perforated metal shield over the recording drum to reduce radiated interference.
Power line fuse	One side of the power line is fused.	Both sides of the power line are fused.
Contrast	Fixed contrast—no adjustment provided.	Internal control provided to vary recording contrast.
Power line cord	Power line cord is integral with set.	Power line cord is removable and is terminated in a female Hubbell twist-lock connector.
Pilot lamp	Pilot lamp is connected between one side of power line and ground to indicate polarity of power line.	Pilot lamp is connected across the power line.
Cabinet	Installation instructions provided on rear of cabinet.	*a.* A barrier strip on a removable plate is provided in the rear of the cabinet for connecting the input, ground and power leads. *b.* Interconnecting leads are provided to connect the barrier strip to the recorder chassis.
Input signal connections	Input signal connection must be made to the recorder chassis.	Input signal connection can be made to either the barrier strip or to the recorder chassis.

8. ELECTRON TUBE COMPLEMENT.

TABLE 1–5. ELECTRON TUBE COMPLEMENT

SUBASSEMBLY	NUMBER OF TUBES OF TYPES INDICATED								TOTAL NO. OF TUBES
	6SN7	6SL7	1635	2D21	6AG7	2H20	6–36	VR75/OA3	
Recorder subassembly									0
Amplifier-detector	2	1							3
Amplifier-modulator	1	1		1					3
Audio-frequency oscillator	1				1				2
Amplifier-power supply	1		3			1	1	1	7
Total number per type	5	2	3	1	1	1	1	1	15

SECTION 2
THEORY OF OPERATION

1. INTRODUCTION.

Facsimile equipment is used to transmit fixed images over an electrical communication system, such as a wire or radio circuit. These images may be maps, pictures, photographs, sketches, typewritten and printed text, or handwriting.

a. THE FACSIMILE TRANSMITTER.—The facsimile transmitter must resolve the sheet of copy to be transmitted into very small elemental areas and transmit the average density of each area separately. The size of these elemental areas must be small enough to resolve the smallest intelligence that is to be transmitted.

An exciter lamp is used as a source of uniform illumination of the copy and a phototube is used to determine the brightness of each elemental area. The copy to be transmitted is clamped on a drum at the facsimile transmitter. An image of the copy is focused upon an aperture plate which is located immediately in front of a phototube. The size of the hole in the aperture plate determines the area of the copy image (the elemental area) which passes through to the phototube.

The phototube acts as a valve in a modulator circuit to control the amplitude of a carrier frequency or tone. When a dark area of the copy is seen by the phototube through the aperture hole, the phototube allows a maximum signal to pass through the modulator circuit. When a white area is seen by the phototube, a minimum signal results. This signal from the phototube modulator is the facsimile signal which is transmitted to the facsimile recorder.

In order to scan each elemental area of the copy, the drum upon which the copy is clamped rotates and at the same time moves sidewise, so that the relative position of the optical system shifts by one elemental area for each drum revolution. When the optical system has completely scanned the copy, all of the elemental areas on the copy have been seen by the phototube and a corresponding amplitude signal has been transmitted for each elemental area.

b. THE FACSIMILE RECORDER.—The facsimile recorder amplifies this facsimile signal, received at the other end of the communication system, and converts it back into corresponding density variations on the recording sheet.

The received facsimile signal is amplified and applied to a small stylus needle which is in contact with the recording paper on a drum similar to that of the transmitter. The drum of the facsimile recorder rotates at the same speed as that of the facsimile transmitter so that the two drums are maintained in the same relative position while a signal is being received.

When a black area of the copy to be transmitted is seen by the phototube, a maximum amplitude signal is transmitted, amplified at the recorder, and impressed upon the recording paper by the stylus to print a corresponding elemental area of maximum density (black). When a white area is seen on the transmitter drum, the signal passed by the phototube modulator circuit is so low that no signal records in the corresponding elemental area of the sheet at the facsimile recorder. When the entire copy has been scanned at the facsimile transmitter, the same copy has been reproduced on the recording paper at the facsimile recorder.

2. GENERAL DESCRIPTION OF ELECTRICAL CIRCUITS.

The course of signal and power currents through the major circuits of the Facsimile Recorder RD–92A/UX is shown in the simplified block diagram of figure 2–1.

a. AMPLIFIER-POWER SUPPLY.—Facsimile signal input and power input lines connect to the amplifier-power supply assembly, which serves as the basic chassis for the recorder. In addition to power supply and control panel circuits, this unit contains the signal input transformer and DENSITY control and a number of independent amplifier circuits needed to amplify the outputs of electronic subassemblies, before passing appropriate signals to the recording mechanism in a separate plug-in subassembly. A comprehensive block diagram of the system is shown in figure 2–2.

b. AMPLIFIER-DETECTOR.—The input facsimile signal, from a wire or radio communication system, consists of phasing pulses and facsimile intelligence between the frequency limits of 900 and 2,700 cycles. This signal, coupled through the input transformer and with signal strength or density level adjusted by the DENSITY control, connects to the amplifier-detector subassembly. Here, it is amplified by a Class *A* amplifier and demodulated through the action of a full-wave rectifier and low-pass filter to form a varying d-c facsimile signal.

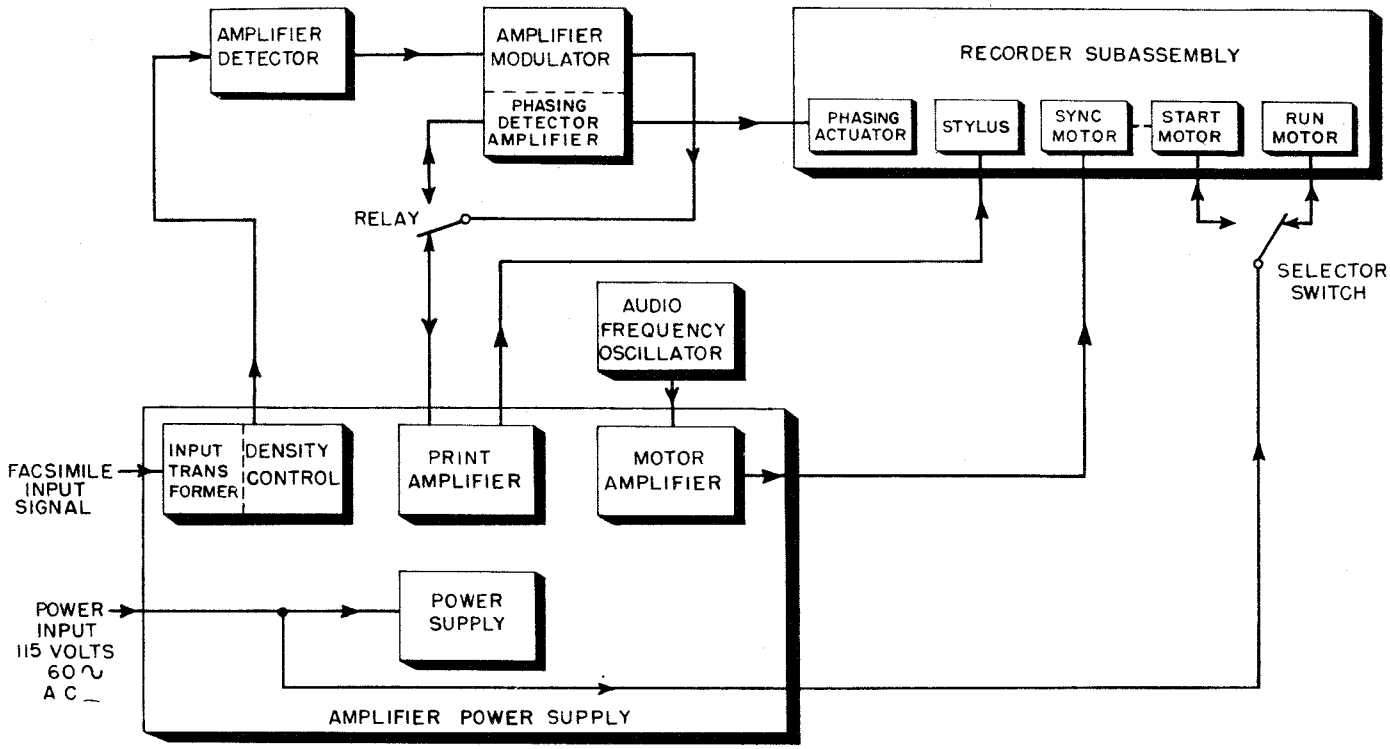


Figure 2–1. Simplified Block Diagram of Facsimile Recorder RD–92A/UX

c. AMPLIFIER-MODULATOR. — The varying d-c facsimile signal output of the amplifier-detector unit is coupled to the amplifier-modulator subassembly, where it combines with a signal from a 15 kc oscillator in a modulator stage. The 15 kc output of the modulator varies with the amplitude of the d-c facsimile signal. The resulting modulated signal connects, through the normally closed contact of relay K1, to the print driver and amplifier in the amplifier-power supply assembly.

d. PRINT DRIVER AND AMPLIFIER.—The signal from the amplifier-modulator unit is amplified by the print driver and amplifier to sufficient intensity, so that, when connected to the stylus needle in the recording mechanism assembly, it will record on the recording paper at points representing dark elements of the transmitted copy.

e. PHASING DETECTOR AND AMPLIFIER.—For phasing pulses, relay K1 is operated to transfer the signal from the amplifier-modulator to the phasing detector and amplifier, located in the amplifier-modulator subassembly. The phasing pulses, which are transmitted at the beginning of each copy, are amplified to operate the phasing actuator in the recorder subassembly.

f. PHASING ACTUATOR.—The phasing actuator, on receiving the phasing pulse, releases the stop bar on the synchronous drive mechanism in the proper position to frame the recorder drum with the drum of the facsimile transmitter.

g. AUDIO-FREQUENCY OSCILLATOR.—The fork controlled audio-frequency oscillator generates an 1800-cycle signal, which is amplified by the buffer amplifier and motor amplifier in the amplifier-power supply assembly and then coupled to the recording mechanism assembly to operate the sync motor. The 1,800-cycle signal also connects to the TEST SIGNAL position on the DENSITY control, where it is available for connection to the input of the signal amplifier for testing the various circuits with the CIRCUIT TEST switch.

h. SYNC, START, AND RUN MOTORS.—The sync motor, rotating at a synchronous speed of 1,800 rpm, is geared down to the required recorder drum speed of 60 rpm. A start motor, mechanically coupled to the sync motor, serves to bring the sync motor up to greater than synchronous speed, after which it coasts down to the sync speed when the sync motor runs on 1,800-cycle power. The sync motor regulates the speed of the recorder drum.

3. CIRCUIT ANALYSIS.

a. GENERAL.—By grouping specific functions of the Facsimile Recorder RD–92A/UX into plug-in subassemblies, a compact circuit arrangement enabling a

quick check of circuit elements is achieved. Block diagrams and circuit schematics of the individual subassemblies serve to explain the specific functions of each unit. Also refer to the over-all schematic, figure 7-4.

b. AMPLIFIER-DETECTOR. — The amplifier-detector subassembly, located at the right side of the recorder, consists of three stages of Class *A* amplification with inverse feedback for greater stability, a full-wave rectifier as part of the demodulator circuit, and an amplifier for the meter test circuit. A block diagram of the unit and the circuit schematic are shown in figures 2-3 and 2-4, respectively.

(1) SIGNAL AMPLIFIER.—The INPUT terminals, located at the top of this unit, connect through the multiple connector, P2, to the input transformer, T1, and DENSITY control, R38, located on the amplifier-power supply chassis. The signal, taken from the rotor of the DENSITY control, returns through pin 5 of the multiple connector, P2, and connects to the grid of the first amplifier V102A, one-half of a 6SL7. The complete signal amplifier consists of two half sections of this 6SL7 (V102A and B) and a half section of 6SN7 (V101B), connected in cascade. Elimination of cathode bypass capacitors results in inverse feedback to stabilize the circuit. Additional inverse feedback is obtained by means of common cathode resistor, R105, for the first and third amplifier.

(2) DEMODULATOR.—The output of the signal amplifier is coupled through transformer T101 to V103, two sections of a 6SN7 connected as a full-wave rectifier. The remaining half section of a 6SN7, V101A, serves as a meter amplifier to measure the d-c output of the amplifier-detector unit in connection with the CIRCUIT TEST switch and meter on the amplifier-power supply control panel. The signal output of the full-wave rectifier, d-c pulses, couples through limiting resistor R109 (10K) to the carrier elimination filter, Z1, located in the amplifier-power supply assembly. Variations in the amplitude of the signal, in the form of varying d-c, are delivered to the load resistor, R33 (22K).

(3) PLATE VOLTAGE.—Plate supply of +100 volts connects directly through P2-pin 7 to the plate circuit of the third amplifier tube and, through decoupling resistor R31 (10K) and P2-pin 1, to the plate circuits of the first and second amplifier tubes.

Regulated +75 volts connects through P2-pin 8 to the plate of the circuit test amplifier, V101A. The test signal is taken from the cathode through P2-pin 9 to R20 in series with R21 (180K) in the CIRCUIT TEST circuit.

(4) FILAMENT VOLTAGE.—The filaments of the tubes are connected in series in the following order: V102, V101, and V103, with one end of V102 connecting to the B-minus lead of the power supply. Leads are taken from the filament string from the opposite end of V102 to provide a parallel connection for V202 on the modulator-amplifier subassembly, and from V203 to connect through P2-pin 4 to the remaining string of series filaments. Across the filament of each tube is connected a neon tube in series with a 270K resistor. If one filament in a string of series filaments burns out, its associated neon tube will light up to indicate the defective tube.

c. AMPLIFIER-MODULATOR. — The amplifier-modulator, a plug-in subassembly located at the rear of the recorder, accepts the facsimile signal output from the low pass filter and puts out a signal that may go either to the print amplifier for application to the stylus or to the phasing detector and pulse amplifier for application to the phasing actuator. The subassembly contains two distinct circuits. One comprises the 15 kc oscillator, modulator and print driver, while the other is the electrical portion of the phasing circuit. *(See block diagram, figure 2-5, the circuit schematic of the unit, figure 2-6, and the over-all schematic, figure 7-13.)*

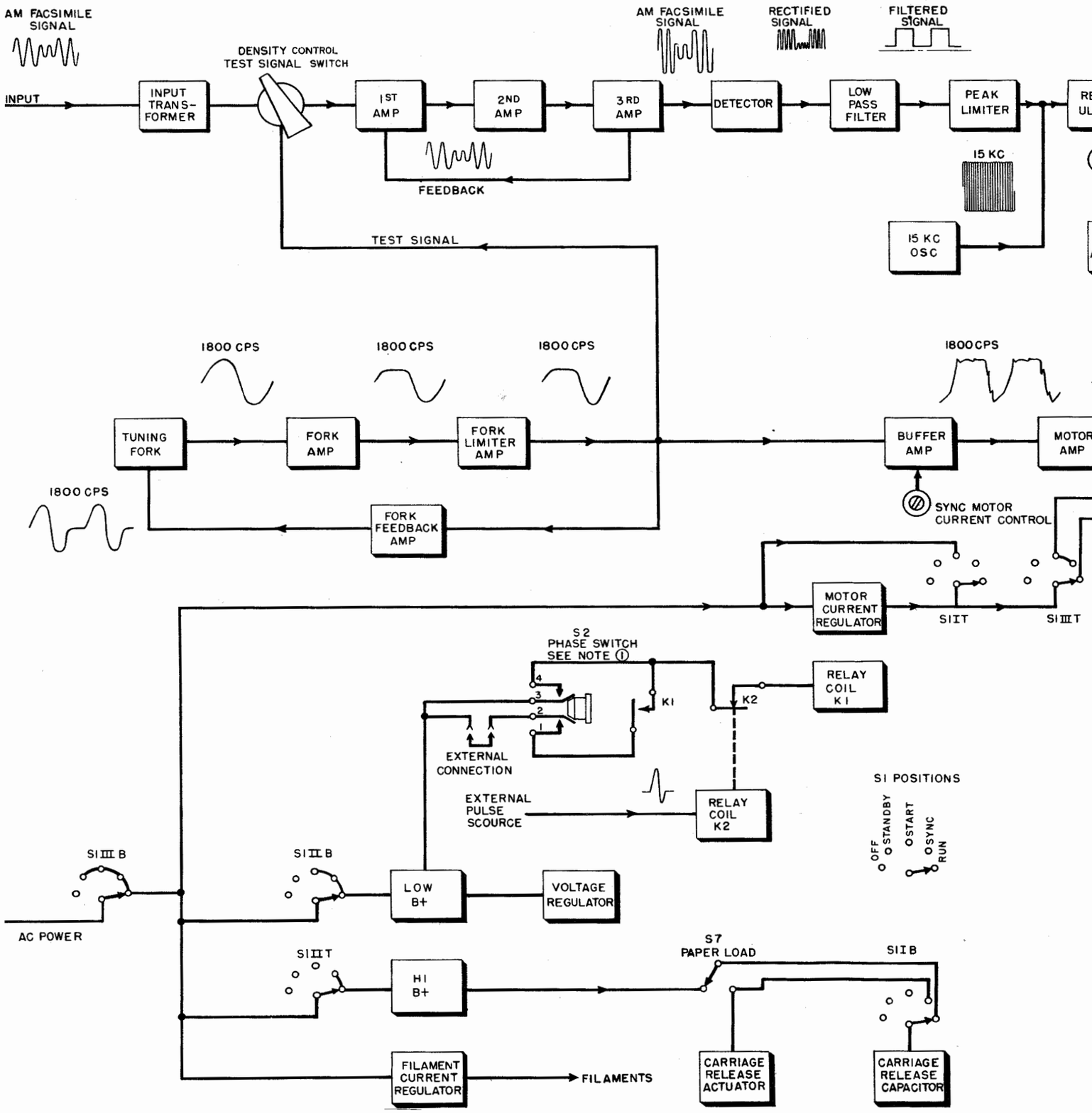
(1) 15 KC OSCILLATOR.—A half section of a 6SN7 (V201B) is connected as a conventional Colpitts oscillator. The frequency determining network Z201, tuned to approximately 15 kc, is driven from the plate of the oscillator tube through capacitor C203 (0.01 mf) and resistor R210 (47K). Limiting resistor R210 controls the voltage fed back from the plate of the oscillator tube into the frequency determining network. The value is such that the oscillator will start quickly, while the voltage fed back will be kept to a limit that will prevent severe distortion of the oscillator waveform. The frequency determining network connects to the grid of the oscillator tube through capacitor C205 (0.01 mf), with resistor R208 (270K) serving as grid leak. The output of the oscillator is coupled through capacitor C204 (0.01 mf) and the voltage divider network of R214 (270K), and R215 (390K), through R213 (1.8 meg), to the grid of the modulator tube V202A.

(2) MODULATOR.—The modulator tube V202A is a half section of a 6SL7. Two voltages applied to the grid of the modulator tube are:

(*a*) the 15 kc signal from the oscillator

(*b*) the varying d-c facsimile signal output of the low-pass filter.

The modulator tube is biased beyond cutoff. The bias voltage is obtained from a voltage divider network comprising R211 (15K) and R204 and potentiometer



NOTES

(1)—PHASE SWITCH S2 HAS LOCAL AND REMOTE POSITIONS. LOCAL POSITION IS INDICATED. IN LOCAL POSITION 1-2 AND 3-4 CONTACTS MAKE WHEN BUTTON IS DEPRESSED. IN REMOTE POSITION 1-2 CONTACTS MAKE CONTINUOUSLY. 3-4 CONTACTS MAKE ONLY WHEN BUTTON IS DEPRESSED.

(2)—WAVE FORMS ARE FOR OSCILLOSCOPE HAVING HORIZONTAL SWEEP FROM LEFT TO RIGHT.

(3)—THIS WAVE IS RECEIVED DURING THE PHASING OPERATION WHEN K1 IS ACTUATED. IT CONSISTS OF A STEADY MAXIMUM SIGNAL INTERRUPTED BY A MINIMUM SIGNAL ONCE PER SECOND.

Figure 2–2. Block Diagram of Facsimile Recorder RD–92A/UX

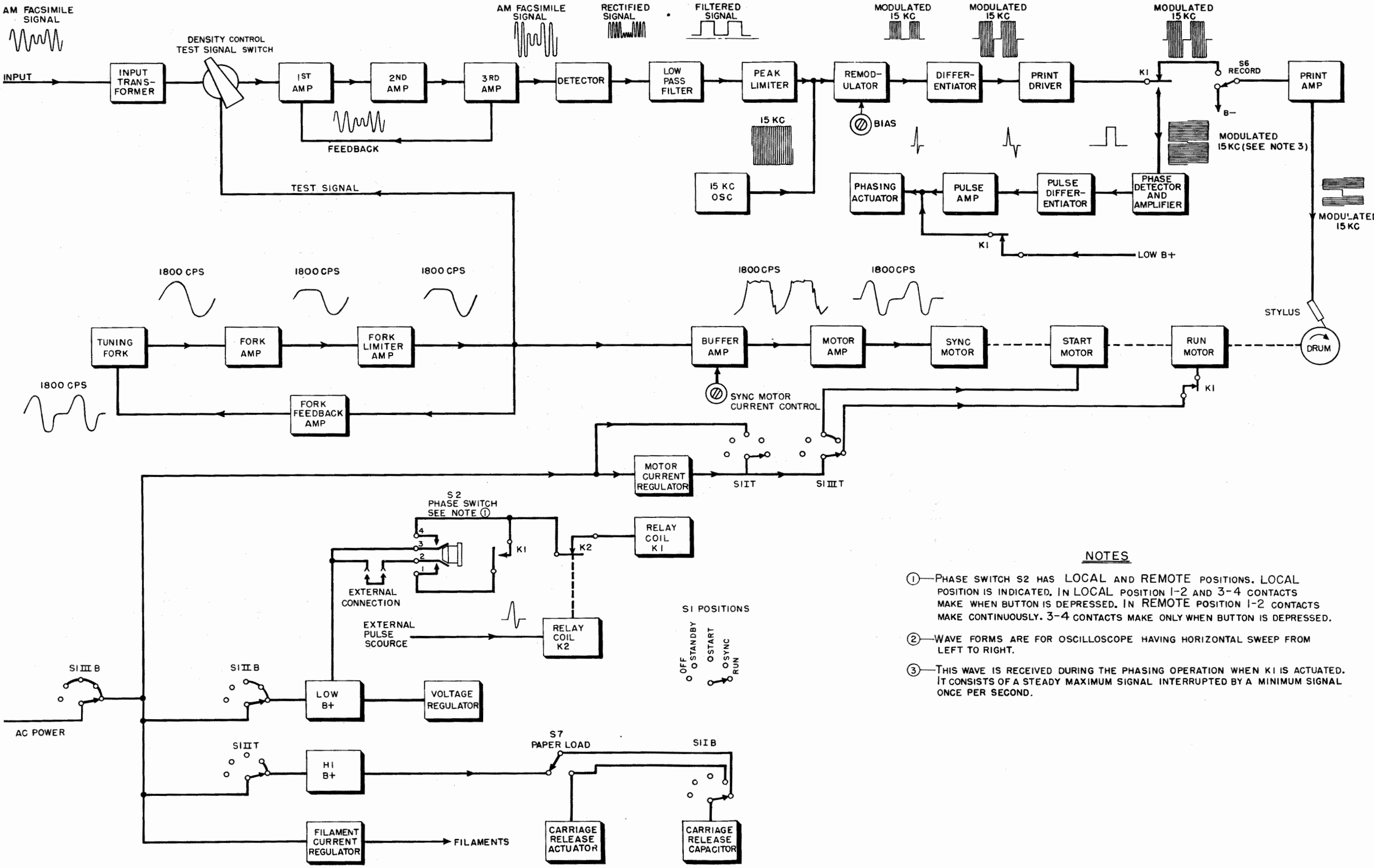


Figure 2–2. Block Diagram of Facsimile Recorder RD–92A/UX

NOTES

① —PHASE SWITCH S2 HAS LOCAL AND REMOTE POSITIONS. LOCAL POSITION IS INDICATED. IN LOCAL POSITION 1-2 AND 3-4 CONTACTS MAKE WHEN BUTTON IS DEPRESSED. IN REMOTE POSITION 1-2 CONTACTS MAKE CONTINUOUSLY. 3-4 CONTACTS MAKE ONLY WHEN BUTTON IS DEPRESSED.

② —WAVE FORMS ARE FOR OSCILLOSCOPE HAVING HORIZONTAL SWEEP FROM LEFT TO RIGHT.

③ —THIS WAVE IS RECEIVED DURING THE PHASING OPERATION WHEN K1 IS ACTUATED. IT CONSISTS OF A STEADY MAXIMUM SIGNAL INTERRUPTED BY A MINIMUM SIGNAL ONCE PER SECOND.

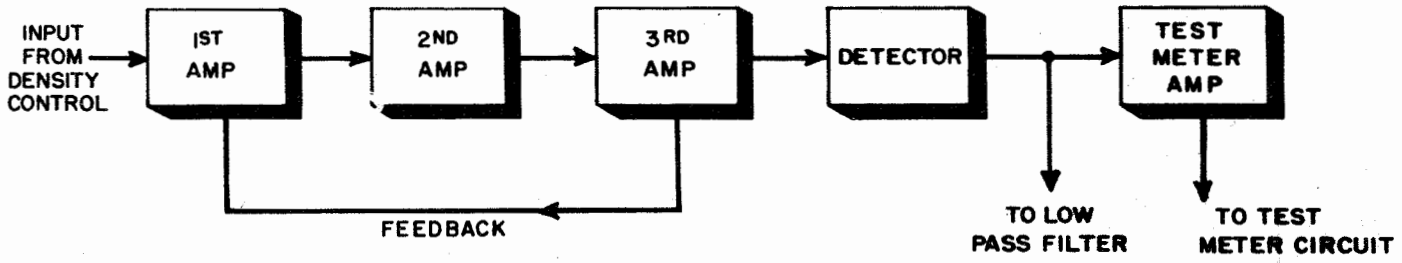


Figure 2–3. Block Diagram of Amplifier-Detector

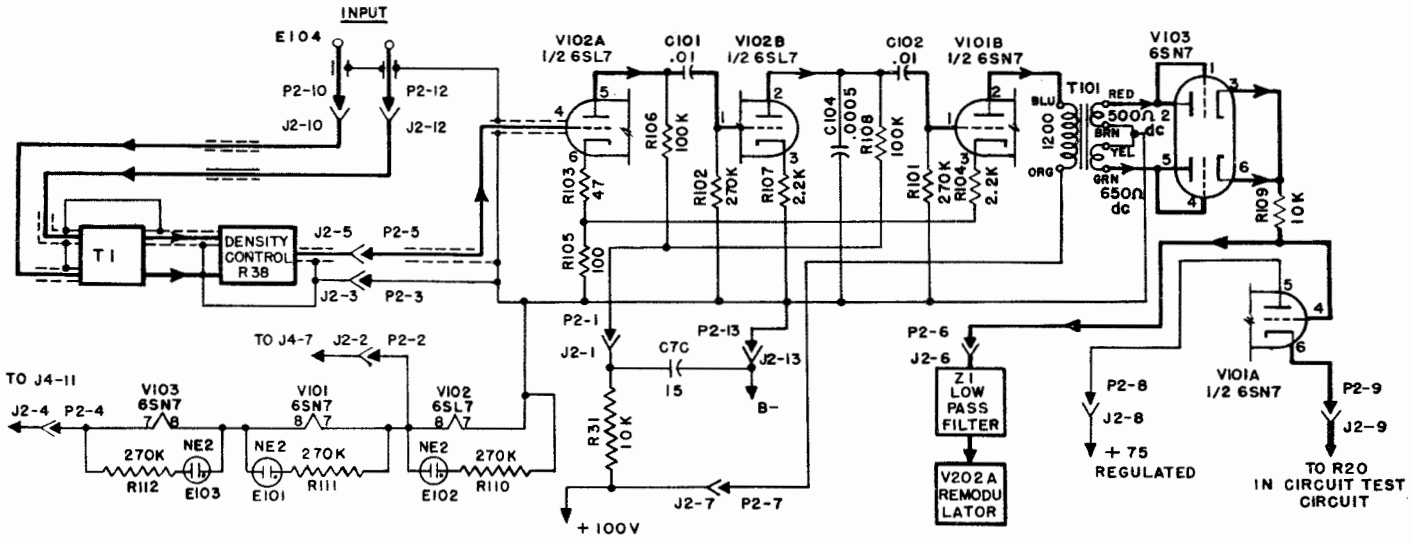
R222 in the cathode circuit. When no d-c facsimile signal appears on the control grid, there is no output from the modulator tube. Since the facsimile signal from the low-pass filter is positive with respect to B—, a maximum signal (corresponding to black) applied to the grid brings the modulator tube into the plate current conducting region. This permits the modulator tube to pass and amplify the 15 kc signal from the oscillator.

(3) PEAK LIMITER.—It is essential to limit the maximum amplitude of the d-c fascimile signal so that the grid to cathode voltage of the modulator tube does not become less negative than is required for Class *A* amplification. To perform this limiting action a crystal rectifier, CR201, is connected between the d-c facsimile signal input lead, P4-pin 1, and the cathode of the modulator tube. When the input d-c facsimile signal overcomes the fixed bias on the modulator cathode, CR201 starts to conduct. This action limits the input d-c facsimile signal to a value equal to the d-c potential at the cathode of V202A. Under this condition the bias between the grid and cathode of the modulator tube is still negative, since the positive d-c facsimile signal applied to the grid has been dropped in amplitude through the voltage divider network of R212 (470K), R213 (1.8 meg), and R215 (390K).

Correct setting of the DENSITY control on the control panel is necessary for proper operation of the modulator circuit. If the DENSITY control is set too high so that CR201 limits appreciably, the background of the transmitted copy will no longer be white and the black lines will widen out somewhat.

If the DENSITY control is set too high and CR201 is open or disconnected, the black lines become white in the center. If the control is set still higher, a complete reversal of picture tone will result so that a negative is received. This reversal effect is caused by the low tube input impedance when the grid is positive, shorting the 15 kc oscillator signal.

For maximum signal output from the modulator tube, a d-c facsimile signal output of about five volts is needed from the low-pass filter, Z1.



NOTE: UNLESS OTHERWISE SPECIFIED
ALL RESISTANCE VALUES ARE IN OHMS,
ALL CAPACITANCE VALUES ARE IN MICROFARADS

Figure 2–4. Schematic Diagram of Amplifier-Detector

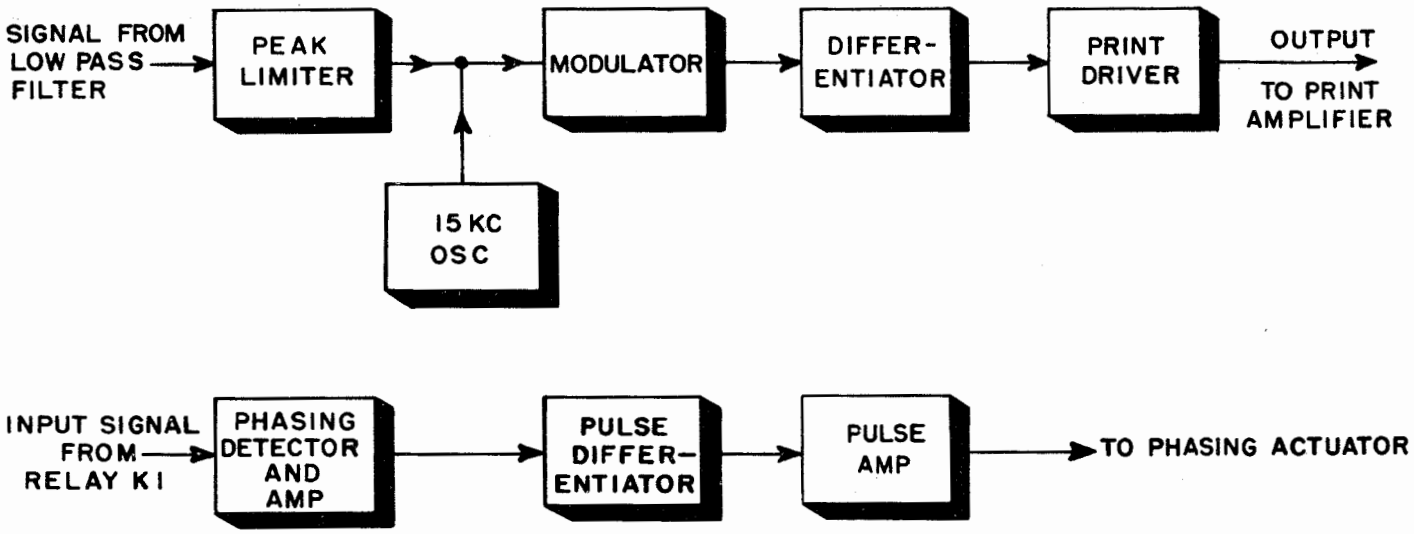


Figure 2–5. Block Diagram of Amplifier-Modulator

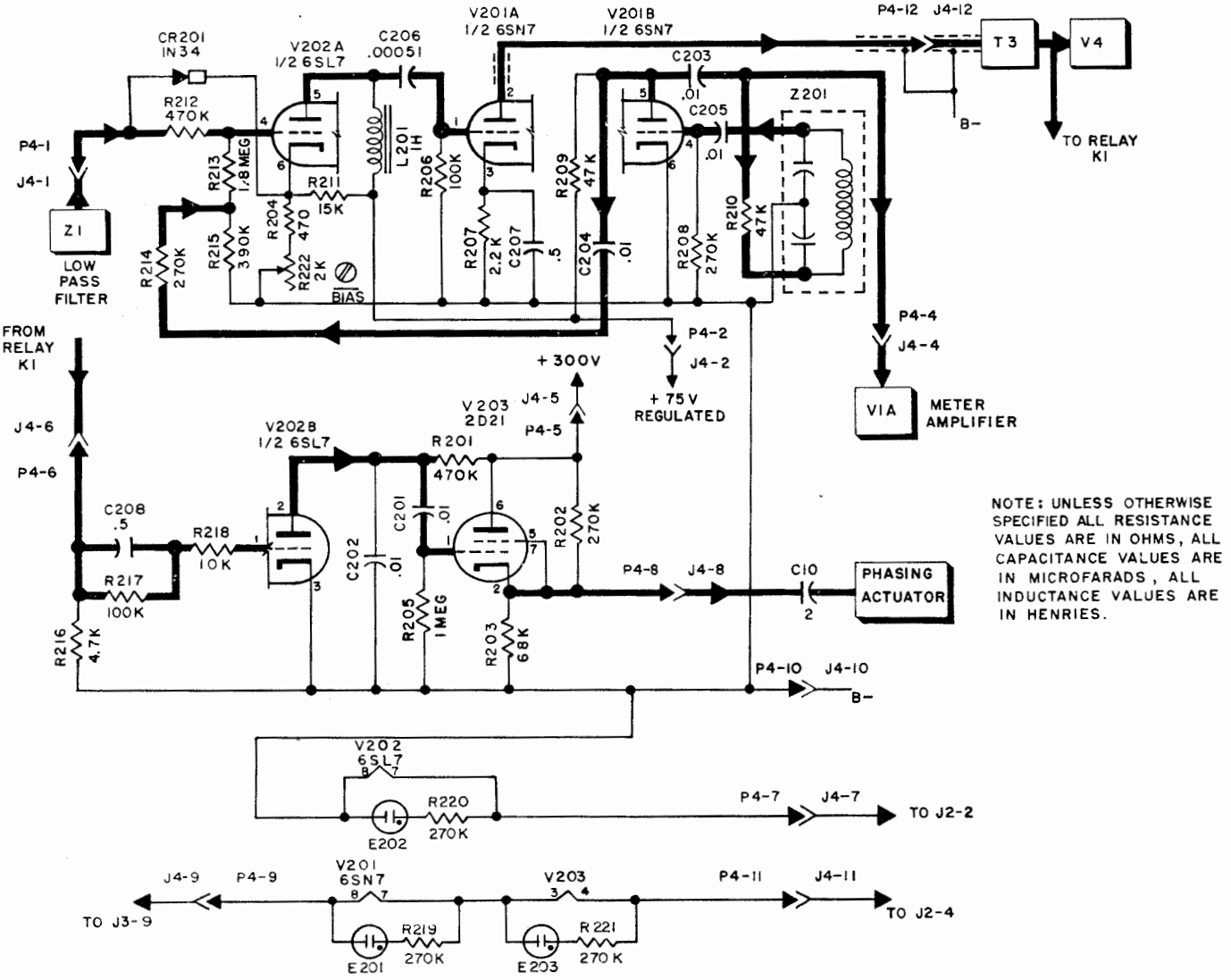


Figure 2–6. Schematic Diagram of Amplifier-Modulator

(4) PRINT DRIVER.—The 15 kc output of the modulator tube is choke coupled to the print driver tube V201A, the remaining half section of the 6SN7. The inductance of the choke, L201, is such that the plate-load reactance is very low for the modulating frequency variations passed by the tube, but is high for the 15 kc signals which represent the black elements of the transmitted facsimile copy and the phasing pulses. The low frequencies are attenuated still further by the short time constant of the coupling capacitor C206 (0.0005 mf) and the grid resistor R206 (100K). The print driver, V201A, is a Class *A* amplifier and is transformer coupled to the print amplifier, located on the amplifier-power supply chassis.

(5) PHASING DETECTOR AND AMPLIFIER.—When the PHASE switch on the control panel is operated to phase the recorder, the output of the print driver transformer, T3, is connected by relay K1 to the input of the phasing detector and amplifier, V202B, through P4-pin 6, V202B. This stage, the second half of the 6SL7, acts with capacitor C208 (0.5 mf) and resistors R217 (100K) and R218 (10K) to form a grid-leak detector to rectify the incoming phasing pulses, which at this point are a series of bursts of 15 kc energy. The product of R218 (10K) and C208 (0.5 mf) controls the charging time of the capacitor, while the time constant of C208 and R217 (100K) controls the discharge time. The circuit eliminates the 15 kc carrier and passes the phasing pulses.

There is no cathode resistor in the V202B circuit, so that when no signal is being received, the grid is at zero potential with respect to the cathode, and plate voltage is extremely low due to current through the plate resistor R201 (470K). Under phasing conditions the grid of V202B swings from plate current cutoff to practically zero, and the voltage at the plate jumps to a maximum value. Capacitor C202 (0.01 mf) improves filtering of the 15 kc carrier. The d-c pulsed output of V202B is coupled through C201 (0.01 mf) to the grid of the thyratron tube V203, a 2D21.

(6) PULSE AMPLIFIER.—A fixed bias from the voltage divider arrangement of R202 (270K) and R203 (68K) is applied to the thyratron tube to prevent the tube from firing until a high amplitude pulse drives the grid to nearly zero bias. When the tube fires on a phasing pulse, the voltage at the cathode increases from its fixed bias value to almost B+ voltage. This positive pulse is coupled to the phasing actuator through P4-pin 8 and capacitor C10 (2 mf). The thyratron circuit is self extinguishing so that it is quickly ready for the next phasing pulse. The voltage, generated by the collapsing magnetic field of the phasing actuator at the end of the phasing pulse, is sufficient to raise the cathode potential of the thyratron momentarily above the plate voltage and extinguish the tube.

(7) PLATE VOLTAGE.—The 15 kc oscillator and modulator require a +75 volt regulated power supply, obtained from the amplifier-power supply chassis through P4-pin 2. Plate voltage for the print driver is obtained through transformer T3, on the amplifier-power supply chassis. The phasing detector and pulse amplifier require a high voltage, +300 volts, obtained from the amplifier-power supply chassis through P4-pin 5. The B— lead connects through P4-pin 10.

(8) FILAMENT VOLTAGE.—The filament of V202, a 6SL7, connects between B—, P4-pin 10, and P4-pin 7 to form a parallel connection with a second 6SL7, V102, on the amplifier-detector subassembly. The filaments of V201, a 6SN7, and V203, a 2D21 thyratron, form part of the series filament string connecting through P4-pin 9 and P4-pin 11. Across the filament of each tube is connected a neon tube in series with a 270K limiting resistor, to indicate a burned out filament.

d. AUDIO-FREQUENCY OSCILLATOR.—The fork controlled audio-frequency oscillator, a plug-in subassembly located on the left side of the recorder, generates an 1,800-cycle signal for synchronous motor operation and for use as a test signal. The unit consists of an 1,800-cycle tuning fork, whose output is amplified by three stages of amplification, with positive feedback to drive the fork. *(See block diagram, figure 2–7, the unit circuit schematic, figure 2–8, and the overall circuit schematic, figure 7–13.)*

(1) TUNING FORK.—The 1,800-cycle tuning fork, I301, has a pick-up coil which provides a signal to the first amplifier stage, V301A, and a drive coil which accepts a feedback signal from the power amplifier stage, V301B.

(2) FORK AMPLIFIER.—The 1,800-cycle fork signal from the fork pick-up coil is applied through a shielded lead to the grid of the fork amplifier, V301A, a half section of a 6SN7. V301A is a Class *A* amplifier with an unbypassed cathode resistor R311 (2.2K) to provide inverse feedback for this stage to stabilize the circuit. The amplified 1,800-cycle signal is resistance-coupled through capacitor C302 (0.01 mf) to the control grid of V302, a 6AG7.

(3) FORK LIMITER AMPLIFIER.—The fork limiter amplifier stage, V302, is connected as a conventional pentode amplifier. Sufficient signal is delivered to the control grid of this stage to cause plate current limiting. This action results in a constant level output, regardless of the input signal received from V301A over the operating range of the fork.

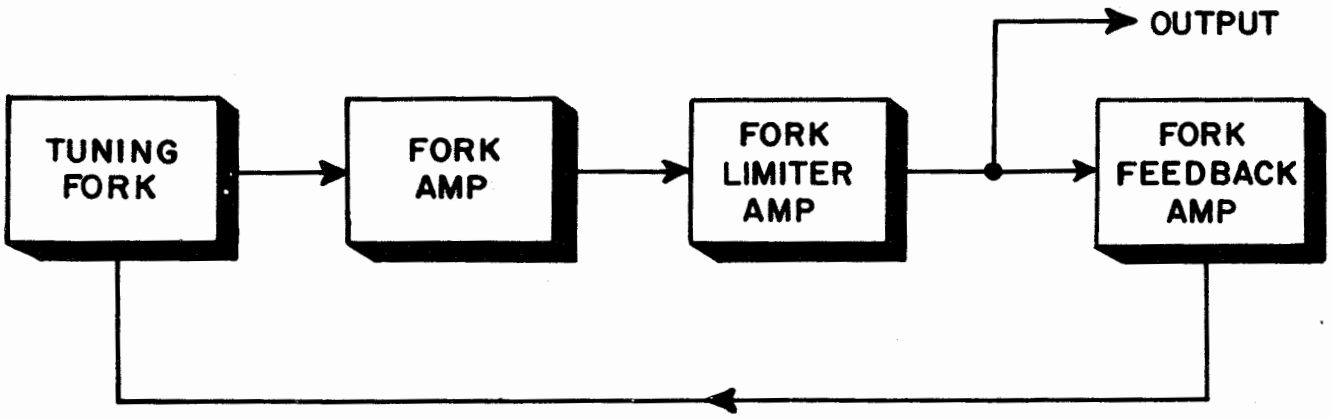


Figure 2–7. Block Diagram of Audio Frequency Oscillator

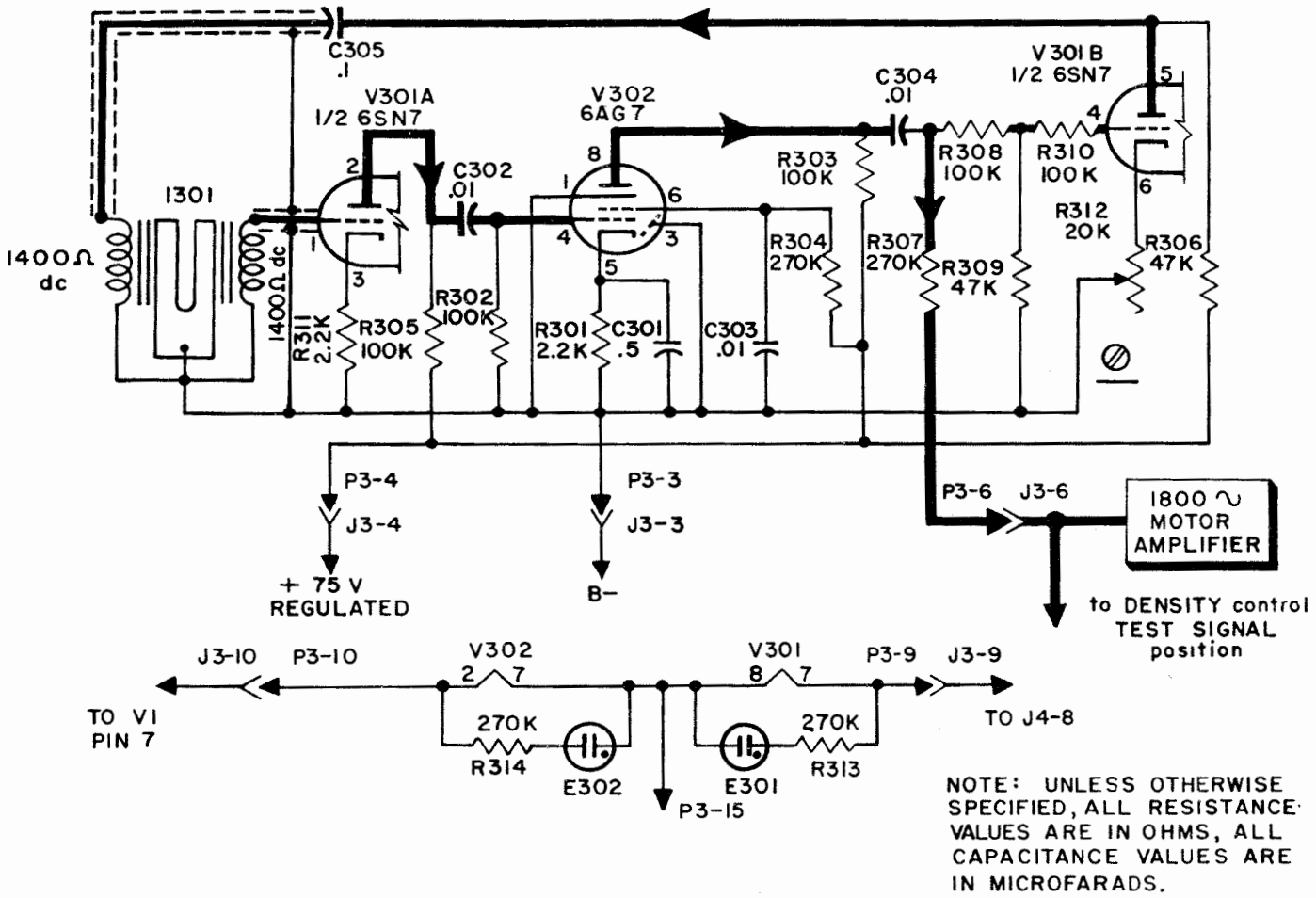


Figure 2–8. Schematic Diagram of Audio Frequency Oscillator

The suppressor grid, pin 1 of V302, is internally connected to the outer metal shell of the tube. Since the suppressor grid must be returned to B—, the outer shell is also at this potential. A bakelite shell is placed over the metal tube to prevent an accidental contact with B—, which is one side of the power line.

(4) FORK FEEDBACK AMPLIFIER.—The output of V302 is coupled through capacitor C304 (0.01 mf), R308 (100K) and R310 (100K) to the grid of V301B, which acts as a power amplifier feeding the drive coil of the fork. Resistors R308 (100K) and R309 (47K) form a voltage divider to reduce the input signal to V301B.

A variable wire-wound resistor R312 (20K) in the cathode circuit of V301B controls the frequency of the fork oscillator. When this resistor is set at the minimum value, maximum signal is delivered to the fork drive coil. This causes the fork to vibrate at a frequency slightly lower than 1,800 cycles. With R312 adjusted for maximum resistance, a minimum signal is applied to the fork drive coil and the fork vibrates at slightly more than 1,800 cycles. The total range of amplitude variation on the fork drive coil is approximately 8 to 1. This results in a frequency variation of approximately plus or minus 0.04 cps from the tuning fork center frequency of 1,800 cycles.

(5) AUDIO-FREQUENCY OSCILLATOR OUTPUT.—The output from the fork controlled audio-frequency oscillator unit is obtained from isolating resistor R307 (270K). This output feeds through P4-pin 6 to provide signal for the motor amplifier and for the TEST SIGNAL circuits in the amplifier-power supply chassis.

(6) PLATE VOLTAGE.—The plate voltage for all stages is regulated +75 volts, obtained from the amplifier-power supply chassis through P3-pin 4.

(7) FILAMENT VOLTAGE.—The filaments of V302 and V301 connect to the string of series filaments through P3-pin 10 and P3-pin 9. Since the filaments of V302 and V301 are approximately in the center of the string of series filaments, a lead is connected from between these two filaments to P3-pin 15 to serve as a reference point for checking in the event two or more filaments burn out at the same time. If only one filament burns out, it is immediately indicated by the neon tube connected across each individual filament, in series with a 270K limiting resistor.

e. AMPLIFIER-POWER SUPPLY.—The amplifier-power supply, which serves as the basic chassis for the recorder, contains a low voltage and a high voltage power supply circuit, the motor driver and power amplifier, the print amplifier and the various metering and switching circuits. (See block diagrams, figures 2–1 and 2–2, the over-all schematic, figure 7–13, and the individual schematics for each circuit.)

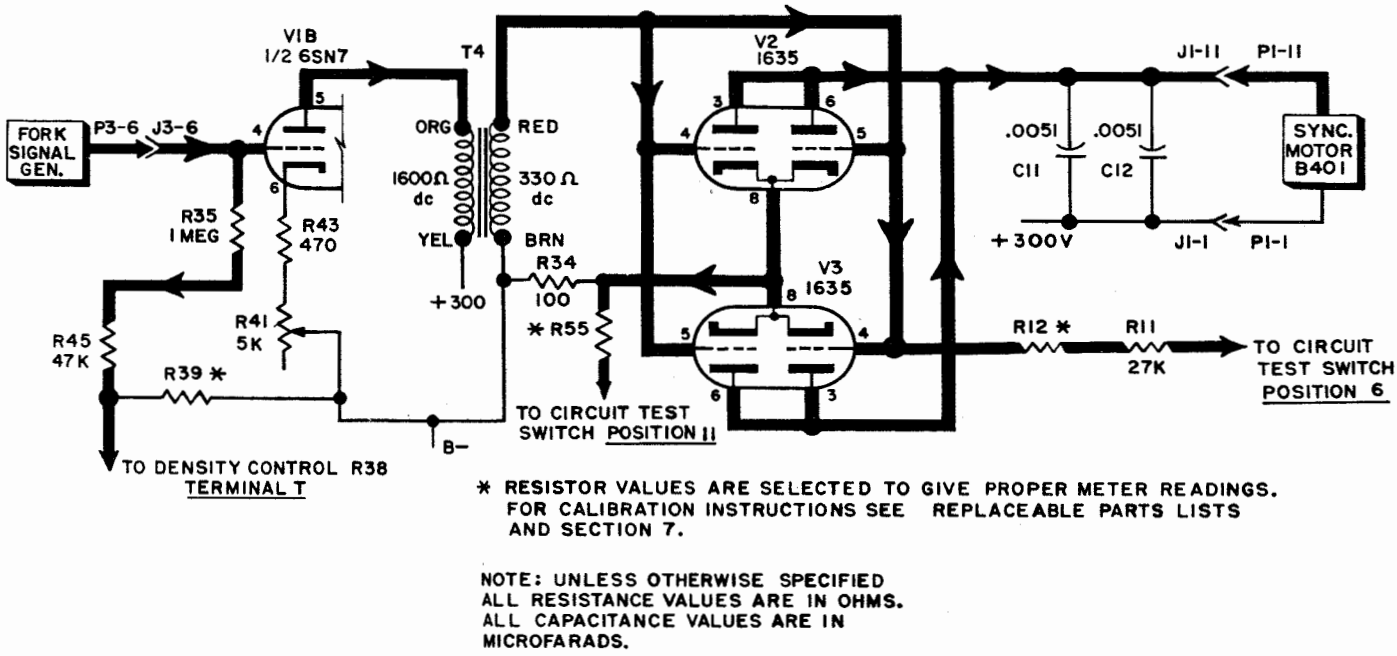


Figure 2–9. Schematic Diagram of Motor Amplifier

(1) MOTOR AMPLIFIER.—(See *schematic, figure 2–9.)* The motor amplifier comprises two stages; V1B, which serves as a buffer stage to isolate the fork oscillator from the motor power circuits and provides sufficient amplification to drive the power stage; and V2 and V3, the motor amplifier tubes, which provide the current to operate the synchronous motor.

The 1,800-cycle signal from the fork oscillator unit connects through J3-pin 6 to the grid of the buffer-motor driver tube, V1B, one-half section of a 6SN7. This stage is a transformer coupled amplifier, with an unbypassed cathode to provide greater stability. The SYNC MA potentiometer, R41, connected in the cathode circuit, controls the amplification of this stage to provide the proper amount of drive for the motor amplifier tubes, V2 and V3.

The output of V1B is coupled through transformer T4 to the grids of the motor amplifier tubes, two 1635's connected in parallel. These are operated with zero bias as Class *B* amplifiers.

The plate load of the motor amplifier tubes is the synchronous motor, B–401, shunted by capacitors C11 (0.0051 mf) and C12 (0.0051 mf). These capacitors resonate with the inductance of the motor coils at a frequency of about 2,000 cycles. This resonant frequency determines the fall-in characteristic of the synchronous motor when it is being started.

Plate voltage for both stages is +300 volts, obtained from the high voltage power supply. The filaments of the tubes are connected as part of the string of series filaments, with individual neon indicators across each filament.

(2) PRINT AMPLIFIER.—*(See schematic, figure 2–10.)* The plate of the print driver in the modulator-amplifier subassembly connects to the print driver transformer, T3, on the amplifier-power supply chassis through J4-pin 12. The secondary of transformer T3 connects to a normally closed contact of relay K1. With the relay deenergized, the print signal is applied to the grid of the print amplifier, V4, when the RECORD button on the recording mechanism assembly is operated. Tube V4, a duo-triode 1635, has both sections connected in parallel to provide power output as a zero biased Class *B* amplifier. The output is transformer coupled through T2 to the stylus needle in the recording mechanism.

(3) LOW VOLTAGE POWER SUPPLY.—*(See schematic, figure 2–11.)* A conventional low-voltage B+ power supply and voltage regulator is used to provide regulated +75 volts to the fork oscillator, the 15 kc oscillator, and the modulator tubes; unregulated 90 to 130 volts to the signal amplifier; and 30 to 45 volts to provide phasing actuator holding current.

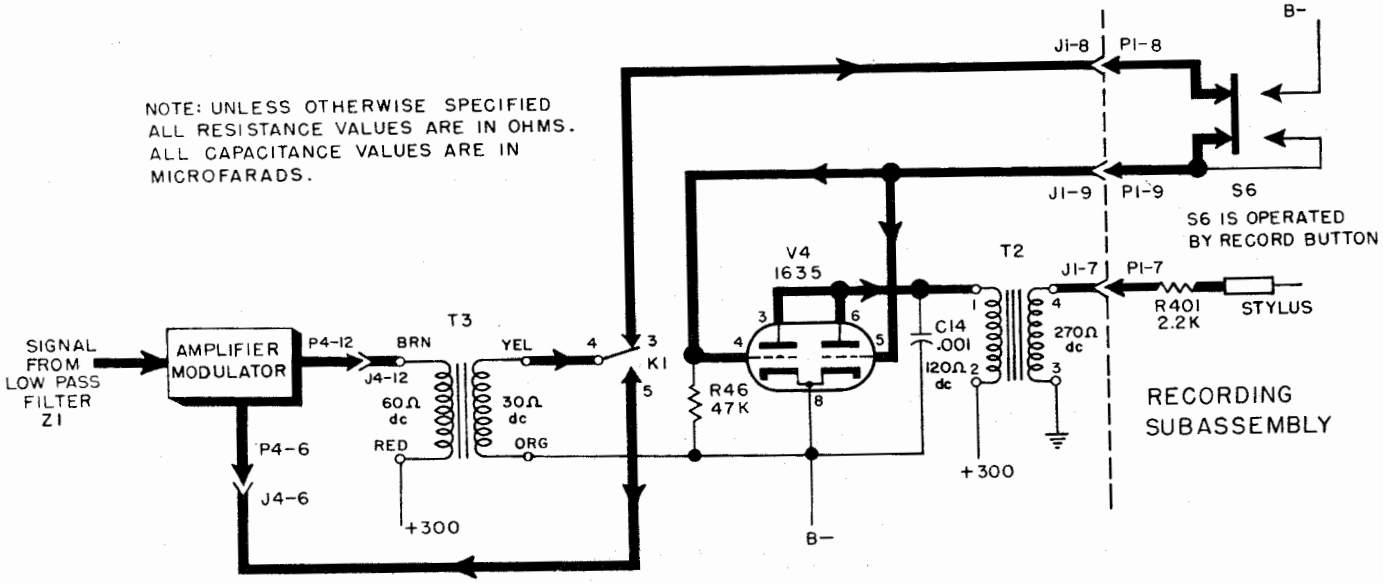


Figure 2–10. Schematic Diagram of Print Amplifier

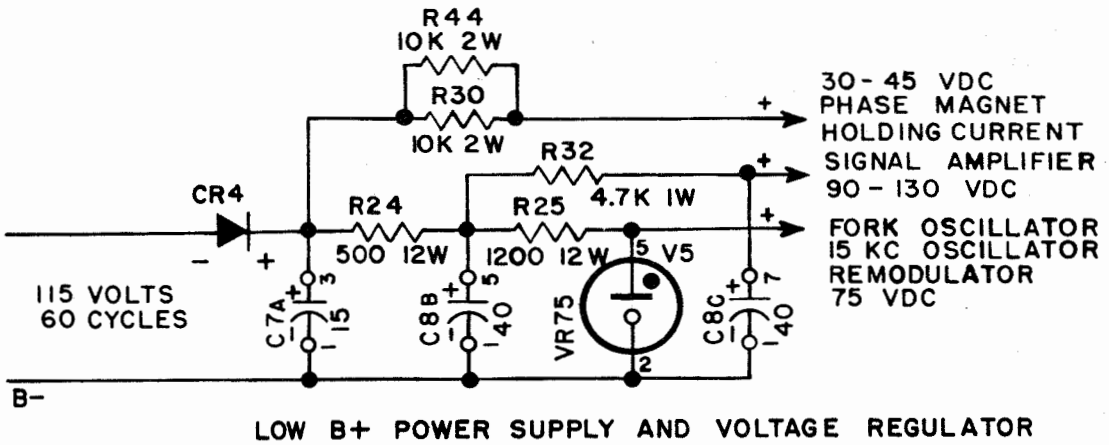


Figure 2–11. Schematic Diagram of Low Voltage Power Supply

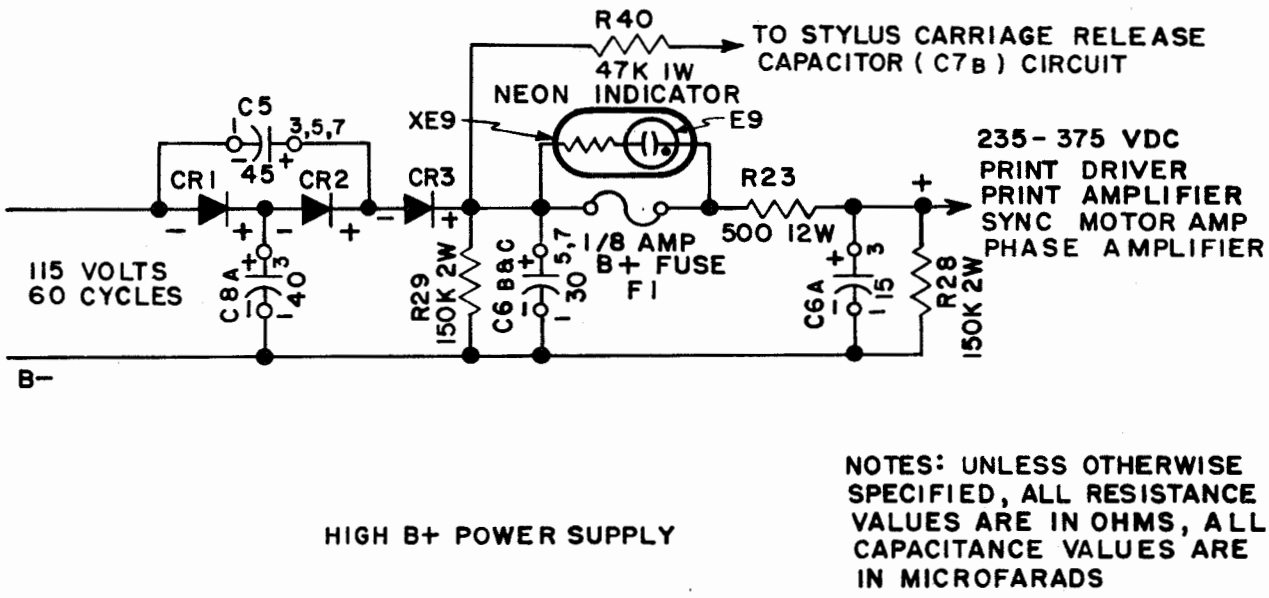


Figure 2–12. Schematic Diagram of High Voltage Power Supply

Applied 110 volt, 60-cycle ac is rectified by a standard 200 ma selenium rectifier, CR4, and the d-c output is filtered by single section filter, C7A (15 mf), R24 (500 ohm, 12 W) and C8B (40 mf). The various low voltage needs are provided by connecting voltage dropping resistors to suitable points in the filter circuit.

(*a*) UNREGULATED VOLTAGE. — Connection of parallel resistors R44 and R30 (each 10K, 2 W) at the input of the filter circuit provides unregulated 30 to 45 volts dc for operation of the phasing actuator holding coil. A second filter section R32 (4.7K) and C8C (40 mf), following the first filter section, provides unregulated 90 to 130 volts for the low current requirements of the signal amplifier.

(*b*) REGULATED VOLTAGE. — Regulated +75 volts, needed to maintain frequency stability for the fork controlled audio-frequency oscillator, the 15 kc oscillator and the remodulator, is obtained by using a cold-cathode, gas-filled voltage regulator tube. Resistor R25 (1,200 ohm, 12 W) limits the current flow through the VR75 and enables the output voltage to be regulated by the characteristics of the tube.

The regulating action may be explained as follows: When the current drain from the regulated supply is small, most of the current through R25 flows through the regulator tube, V5. If the current drain from the supply is high, the current through the regulator tube is reduced. A similar effect results when the d-c input to the resistor and regulator tube combination is varied. The regulator tube automatically adjusts its current drain, so that the voltage applied to the load is maintained substantially constant at +75 volts.

(4) HIGH VOLTAGE POWER SUPPLY.— *(See schematic, figure 2–12.)* The high voltage power supply is obtained from a voltage tripler circuit, eliminating the need for heavy transformers and chokes.

(*a*) VOLTAGE TRIPLER.—Voltage tripling of the applied input voltage results from the selective charging of a number of capacitors in such a manner that their voltages add. When the first positive half cycle of the 115 volt, 60-cycle power source is applied to the voltage tripler circuit the rectifiers CR1, CR2, and CR3, all connected in series, will conduct. As a result, capacitors C8A (40 mf) and C6B and C (total 30 mf) which are across the line, charge up to the peak line voltage. On the negative half cycle, since the polarity of the applied voltage has been reversed, rectifiers CR1 and CR3 do not conduct. However, capacitor C8A now discharges through CR2 to charge up capacitor C5 (45 mf) in series with the line voltage. Capacitor C5, therefore, charges to a voltage higher than the peak line voltage. During the next positive half cycle, CR1 conducts and recharges C8A. At the same time the voltage of the charged capacitor C5 in series with the line voltage is applied to CR3, which conducts to charge C6B and C (two sections connected in parallel). After a few cycles of operation, the voltage across C5 is twice the line voltage (voltage doubler) and the voltage across C6B and C is three times the line voltage (voltage tripler).

(*b*) VOLTAGE TRIPLER OUTPUT.—Both an unfiltered and a filtered output are taken from the voltage tripler circuit. The unfiltered output is taken from the junction of CR3, C6 (B and C) and bleeder resistor R29 (150K) to provide the charging voltage through R40 (47K) for the carriage release capacitor. The output of the tripler circuit is filtered by a filter section comprised of R23 (500 ohm, 12 W) and capacitor C6A (15 mf) and bleeder resistor R28 (150K, 2 W), to stabilize the output. The filtered 235 to 375 volt output of the voltage tripler provides the required high voltage for operation of the print driver, print amplifier, sync motor amplifier, and the phase amplifier circuits.

(*c*) ONE-EIGHTH AMP B+ FUSE.—The 1/8 ampere B+ fuse, located on the control panel, is connected in the filter section of the voltage tripler to protect the circuit from overload. Neon indicator, E9, is connected across the fuse to indicate when it is blown.

(5) SWITCHING CIRCUITS ON CONTROL PANEL.—There are three switching circuits on the control panel of the amplifier-power supply chassis that control basic functions of the recorder. These are the SELECTOR, PHASE, and CIRCUIT TEST switches.

(*a*) SELECTOR SWITCH CIRCUIT.—*(See figure 2–13.)* The selector switch is a three-section two-pole wafer switch with five positions. The five switch positions are: OFF, STANDBY, START, SYNC, and RUN.

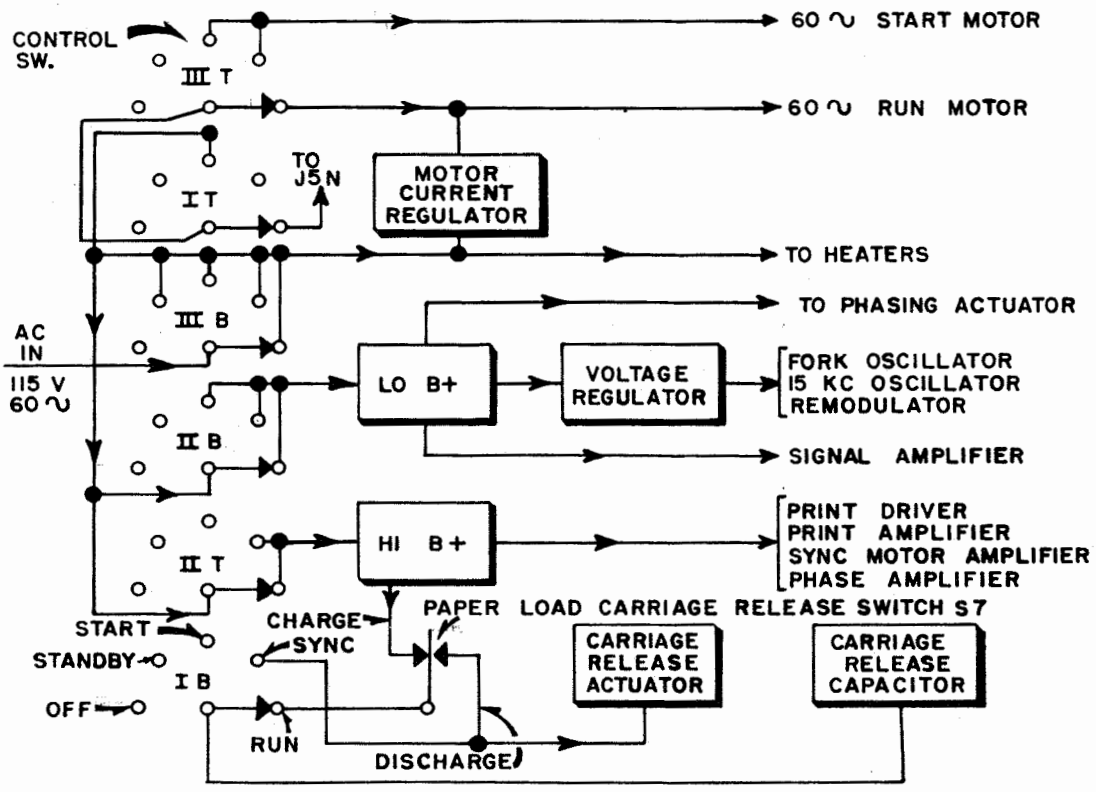


Figure 2–13. Block Diagram of Selector Switch Functions

1. OFF.—One side of the 115 volt, 60-cycle a-c input line connects to the rotor of section IIIB of the selector switch. When the switch is in the OFF position, the a-c line is open and there is no connection to any circuit.

2. STANDBY.—When the rotor of switch section IIIB is moved to the STANDBY position, the 115 volt a-c circuit connects to the string of tube heaters in series. All tubes are turned on. From the STANDBY contact of switch Section IIIB, there is connection to the rotating arms of sections IIT, IIB, and IT and through the motor current regulator to IIIT, so that 115 volts ac is now available at those switch sections. However, there is no connection to the STANDBY contact of any section other than IIIB.

3. START.—On switch section IIIB, the STANDBY, START and RUN contacts are all connected together, so that in the STANDBY and succeeding positions voltage continues to be supplied to the tube heaters. The 115 volts ac available at the rotor of section IIB now connects to the input of the low voltage power supply, energizing that circuit and providing plate voltage for the signal amplifier, phasing actuator, audio-frequency oscillator, 15 kc oscillator, and remodulator. Sections IT and IIIT close the power circuit to the start motor. The start motor is mechanically coupled to the synchronous motor so that the synchronous motor is brought up to above synchronous speed.

4. SYNC.—Power is now applied through the motor current regulator and section IIIT to reduce and regulate current to the start motor. Section IIT applies 115 volts ac to actuate the high voltage power supply to provide plate voltage to the print driver, print amplifier, sync motor amplifier and phase amplifier. 1,800-cycle power is applied to the synchronous motor. The synchronous motor speed coasts down and locks into synchronism, while the drum still remains stationary.

5. RUN.—Power is switched through section IIIT from the start to the run motor. The run motor turns the drum and drives it against the stop bar rotated by the synchronous motor. Switch section IB connects the unfiltered output of the high voltage power supply to charge the carriage release capacitor.

(*b*) PHASE SWITCH.—*(See simplified schematic, figure 2–14.)* The phasing switch S2, located just above the selector switch RUN position, actuates circuits which set the drum synchronizing mechanism in step with received phasing pulses. The switch has two positions, LOCAL and REMOTE.

1. LOCAL.—The PHASE switch is normally left in the LOCAL position (rotated to the left). When phasing pulses are being received, the PHASE switch is depressed by the operator. This closes normally open contacts, 1–2 and 3–4, and applies 115 volts dc through closed contacts 1–2 of relay K2 to the actuating coil of relay K1. Actuation of relay K1 performs a number of switching operations. In particular, contacts 6–7 open the holding current circuit to the phasing actuator. This causes the phasing actuator armature to release and catch the stop bar of the drum synchronizing mechanism. A phasing pulse, firing the thyratron in the modulator-amplifier unit, causes the phasing actuator armature to retract momentarily and release the stop bar. When the operator releases the PHASE switch, relay K1 is deenergized, the holding current circuit is again closed and the phasing actuator armature retracts to permit continuous rotation of the stop bar in the properly phased position.

2. REMOTE.—The REMOTE position, the PHASE switch rotated to the right, is used only when Automatic Start and Transfer Unit AST–( ) is connected to the recorder and signals are being received from a TXC–A3 or other type facsimile transmitter which transmits a *start* signal. In the REMOTE position contacts 1–2 are closed, while contacts 3–4 close only when the PHASE switch is depressed. Now, when the operator momentarily depresses the PHASE switch to energize relay K1, contacts 1–2 of relay K1 complete a holding circuit through contacts 1–2 of the PHASE switch and a jumper between pins J and A of the connector of the AST unit which plugs into J5. This holding circuit continues to apply power to the holding coil of relay K1 after the PHASE switch is released. The recorder is now set to phase and start automatically without the presence of a receiving operator. A *start* signal from the facsimile transmitter triggers relay K2, which releases relay K1 and starts the recording.

If an AST unit is not used, the recorder will operate the same as if the PHASE switch were in LOCAL position.

(*c*) CIRCUIT TEST SWITCH.—*(See simplified schematic, figure 2–15.)* CIRCUIT TEST switch, S4, provides a means for a quick circuit check when trouble is encountered. Basic circuits are checked at each of eleven test positions. The meter at the center of the control panel, Meter M1, serves as indicator. The normal operating condition for all tests, unless otherwise indicated, is to have the synchronous motor running in SYNC position and the DENSITY control switched to TEST SIGNAL position. The test is then made by rotating the switch pointer to the position indicating the circuit to be tested and depressing the

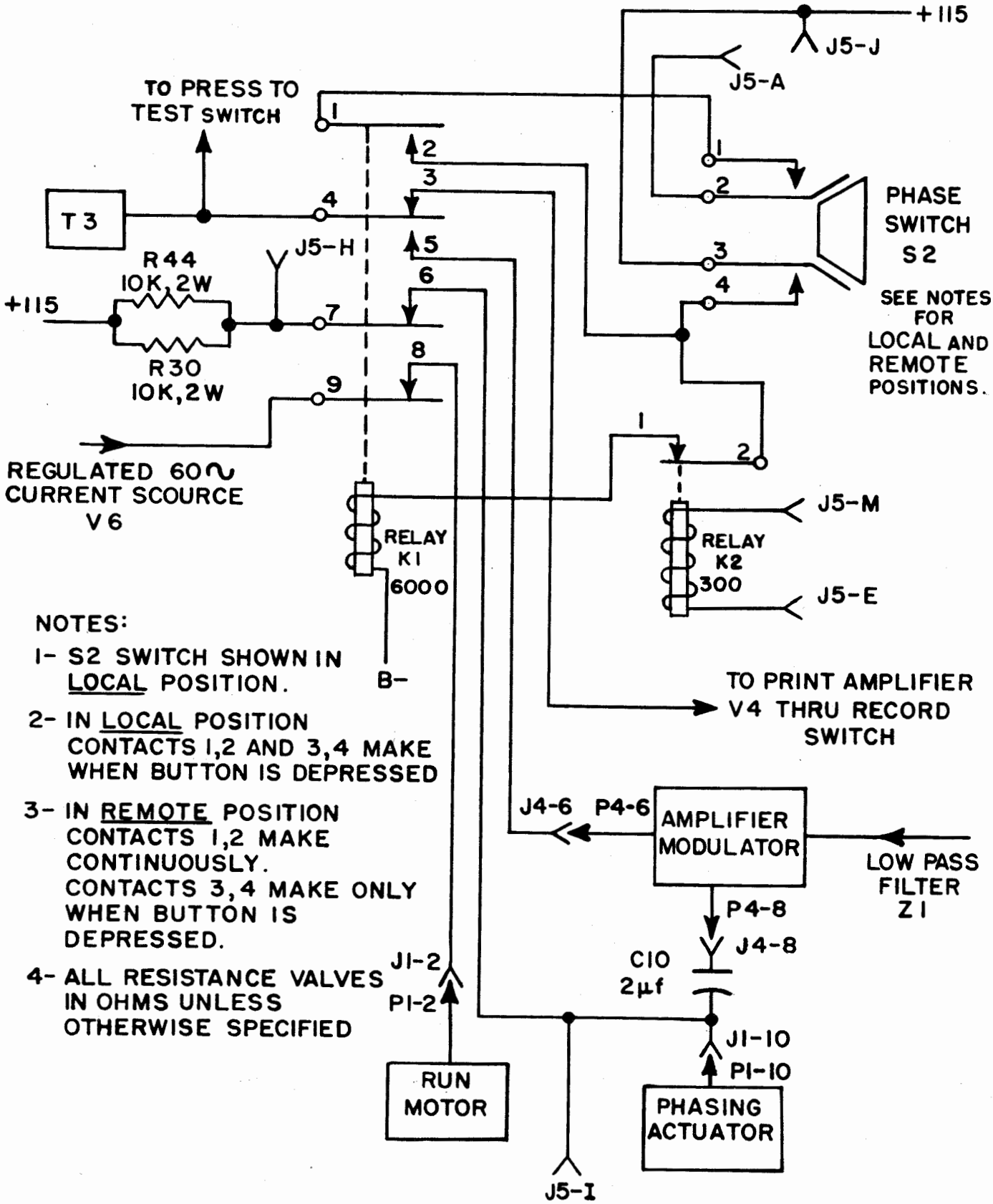


Figure 2–14. Simplified Schematic of Phasing Control Circuit

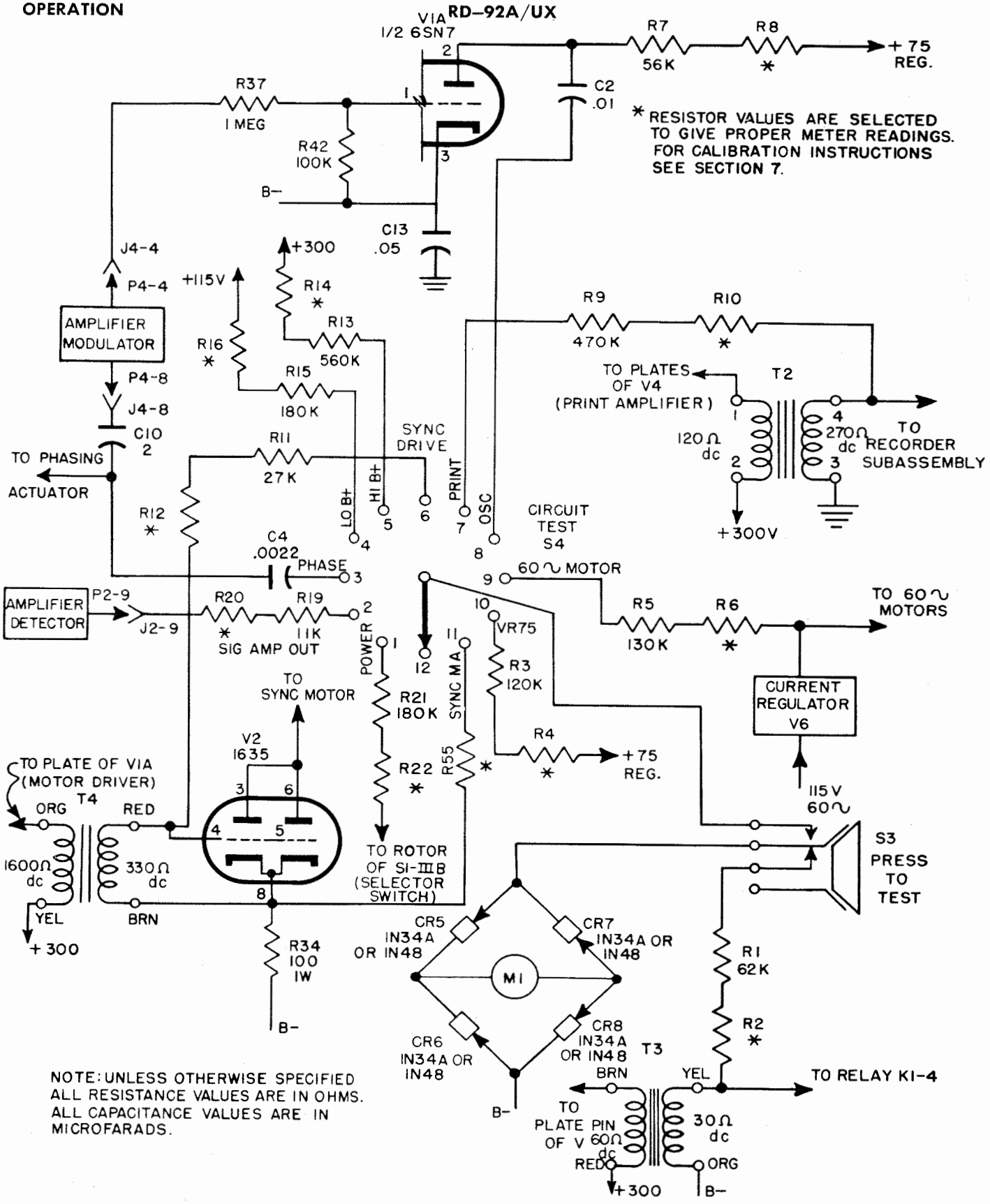


Figure 2–15. Schematic Diagram of Test Circuits

PRESS TO TEST switch. Under the above conditions, the normal meter reading for all positions except PHASE AMP and PRINT is approximately 100. This uniform test reading for all positions results from the inclusion of a correcting resistor, marked *, in each circuit to give the desired uniform meter reading under normal operation.

The specific test circuits are analyzed in par. 5., TEST PROCEDURES, this Section.

4. MECHANICAL FUNCTIONS.

a. GENERAL.—The basic mechanical functions of a facsimile recorder of this type are to rotate a drum at a constant speed in synchronism with that at the transmitter and to feed a stylus needle along the drum, one scanning line for each revolution, until the complete drum has been covered, and then to return the stylus to its initial position for the reception of new copy.

Facsimile Recorder RD–92A/UX uses three motors as prime movers in the performance of these functions. *(See figure 2–16.)* The run motor (1) drives the drum (8) through the reduction gears (20) and the inner shaft (9). An extension of the inner shaft goes completely through the drum and is fastened to the drum at the opposite end.

The synchronous motor (2) and the start motor (not shown in diagram) are on a common shaft. These motors do not drive the drum directly, but rotate the

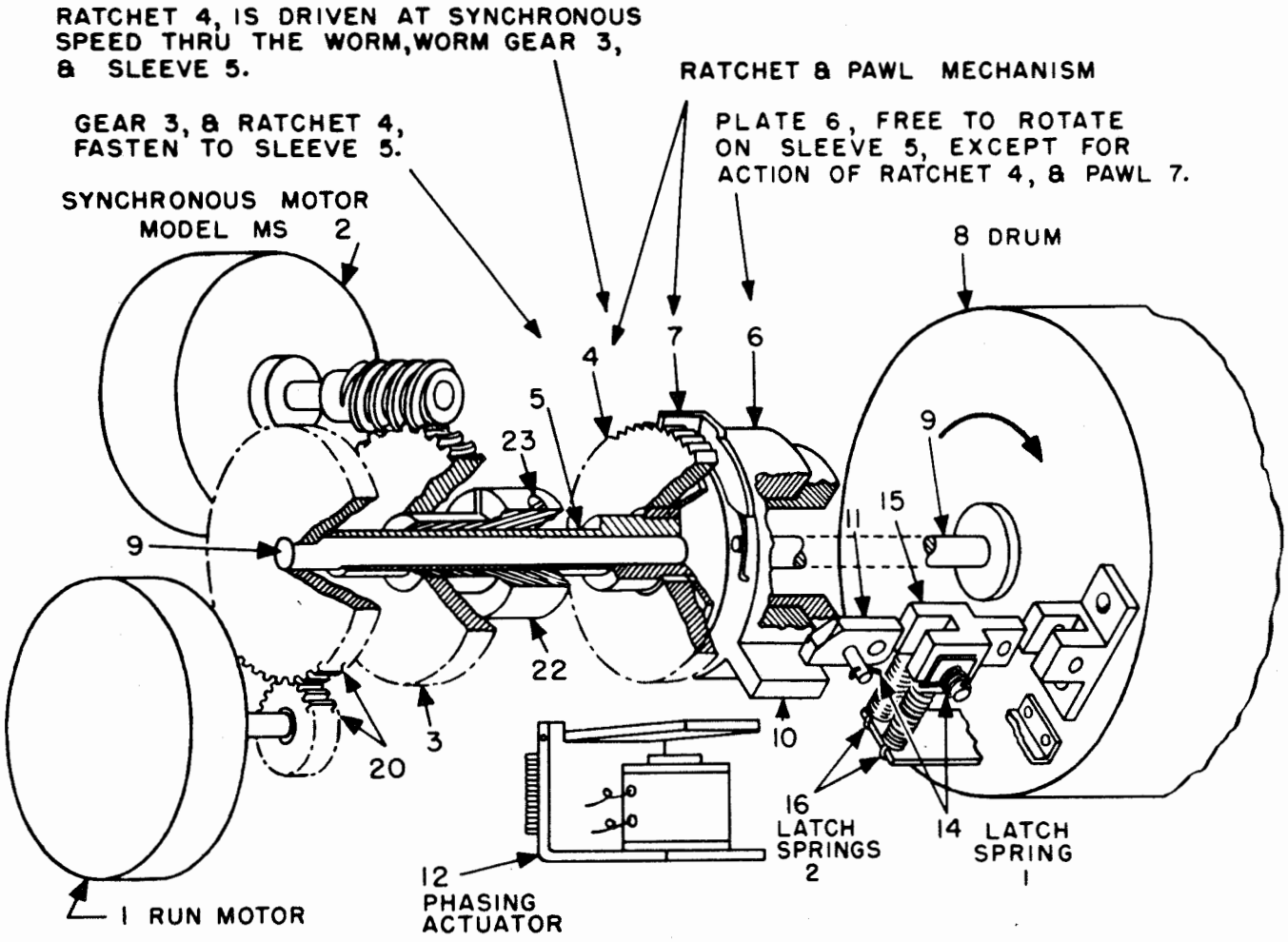


Figure 2–16. Details of Synchronous Drive and Phasing Mechanism

ratchet and pawl mechanism (4 and 7) through the shaft sleeve (5). The synchronous motor runs in synchronism with the 1,800-cycle signal from the fork controlled audio-frequency oscillator, amplified by the motor amplifier tubes. Since it is not self-starting, the synchronous motor must be brought above synchronous speed by the start motor and then allowed to coast down into synchronism. With the motor at synchronous speed, the worm and worm-gear arrangement (3) brings the speed of the sleeve, ratchet, and pawl to 60 rpm.

When power is applied to the run motor, the drum is geared to rotate in the direction indicated at a speed somewhat higher than 60 rpm. The latch (11), attached to the drum, soon catches up with the stop bar (10) on the ratchet and pawl assembly, and is held back so that the drum rotates at the synchronous speed of 60 rpm. The latch is hinged to the drum in such a manner that, when the run motor is not operating, the latch will trip and allow the ratchet and pawl mechanism to rotate without turning the drum.

The stylus needle records on recording paper fastened to the drum, when the RECORD button is depressed with the recorder operating in RUN position. The stylus needle is held in a carriage assembly which moves across the drum to the right when engaged with a leadscrew shaft geared to the drum. When the carriage assembly reaches the right end of the recorder paper, it operates an automatic release mechanism which disengages the carriage mechanism from the leadscrew and lifts the stylus from the paper. A return spring, located in the left-side gear box, then pulls the carriage back to the left-side of the drum, so that it will be ready for the next copy.

b. SYNCHRONOUS AND START MOTORS.—*(See figures 2–16 and 2–17.)* The model MS synchronous motor used in the recorder is basically a Lacour phonic wheel motor. Its speed is held constant at 1,800 rpm by 1,800-cycle power supplied by the motor amplifier tubes. A double thread worm on the motor shaft meshes with a worm gear to drive the shaft sleeve, ratchet, and pawl mechanism at 60 rpm. The worm gear (3) is clamped to the sleeve (5) by the clamping screw (23) on the split clamping ring (22). *(See figure 2–16.)* The rotor of the synchronous motor fastens directly to the shaft. The stator fastens to the casting through a spring (24 of figure 2–17), with limiting screws adjusted to allow no more than 1/32 inch rotation of the stator in either direction.

The start motor, shown in figure 2–17, is a 60-cycle shaded pole induction motor. The rotor of the start motor is on the same shaft as that of the synchronous motor, so that it can start the synchronous motor by bringing its rotor up above the synchronous speed of 1,800 rpm when the selector switch is set in START position. In the SYNC position a small amount of power is still applied to the start motor, through the motor current regulator, to prevent the synchronous rotor from coasting down too fast and through synchronous speed. In SYNC position, the current to the start motor is regulated at 0.2 amp by the action of current regulator tube V6, a 2H20 located on the amplifier-power supply chassis.

c. RUN MOTOR SYSTEM.—The run motor system which drives the drum and leadscrew shaft consists of a shaded pole 60-cycle induction motor geared down through a 25 to 1 reduction gear train. The motor attempts to rotate the drum at 90 to 100 rpm, until the drum is held back by the ratchet and pawl mechanism.

d. DRIVE SUBASSEMBLY AND PHASING SYSTEM.—*(See figure 2–16.)* The drive subassembly holds back the drum to a synchronous speed of 60 rpm and allows phasing of the drum with the phasing signals from the facsimile transmitter. The mechanism functions as follows:

The latch arm (11), fastened through latch springs (16) to the left-hand side of the drum, drives up against the stop bar (10) on the ring (6) to hold the drum at synchronous speed. The latch arm is so arranged that it cannot pass the stop bar when the drum is trying to rotate faster than the drive subassembly. However, if an abnormal amount of force is exerted, latch springs (16) operate as a safety measure to allow the latch arm to pass the stop bar. When the drum is not rotating, the stop bar, driven by the synchronous motor mechanism, moves past the latch arm. The latch arm is hinged and supported by the light latch spring (14) to permit the stop bar to move past it against only light spring pressure.

When the PHASE button of the recorder is depressed, the armature of the phasing actuator (12) releases and moves into position to stop rotation of the stop bar and ring (6). The synchronous motor drive continues to rotate ratchet plate (4) at 60 rpm, slipping under the pawl (7) attached to the ring. With this arrangement, the synchronous motor need apply only a small amount of power during phasing, since the ratchet and pawl present only a very light load.

When the phasing pulse is received, the armature of the phasing actuator is retracted momentarily to release the stop bar, allowing the pawl to engage the ratchet and the ring to rotate with the ratchet plate. The stop bar picks up speed without the pawl slipping

more than one tooth. The ring is now phased with that of the facsimile transmitter, and the operator may now release the PHASE button. While the PHASE button is still depressed, the armature of the phasing actuator retracts each time a phasing pulse is received at the same instant that the stop bar touches the armature, so that the ring is not thrown out of phase.

When the selector switch is turned to RUN position the drum at first rotates at a speed in excess of 60 rpm, so that the latch on the drum comes up behind the stop bar. This exerts pressure on the ring to force the pawl into one of the ratchet teeth and hold the drum to exactly 60 rpm. Since the load of the drum is applied against the locking side of the ratchet, the pawl cannot slip regardless of how hard the drum hits the stop bar.

e. DRUM ASSEMBLY AND PAPER LOAD MECHANISM.—The 6-inch diameter hollow drum is keyed to a central shaft which rotates in ball bearings. In addition to the latch arrangement within the drum which acts as part of the phasing system, the drum assembly carries the paper clamp on the outside.

The drum shaft is driven by the run motor operated inner shaft (9) which meshes with a key in the drum shaft. A thrust spring on the right-hand gear box cover keeps the drum shaft engaged with the inner shaft. The drum is keyed to the drum shaft by a slide plate on

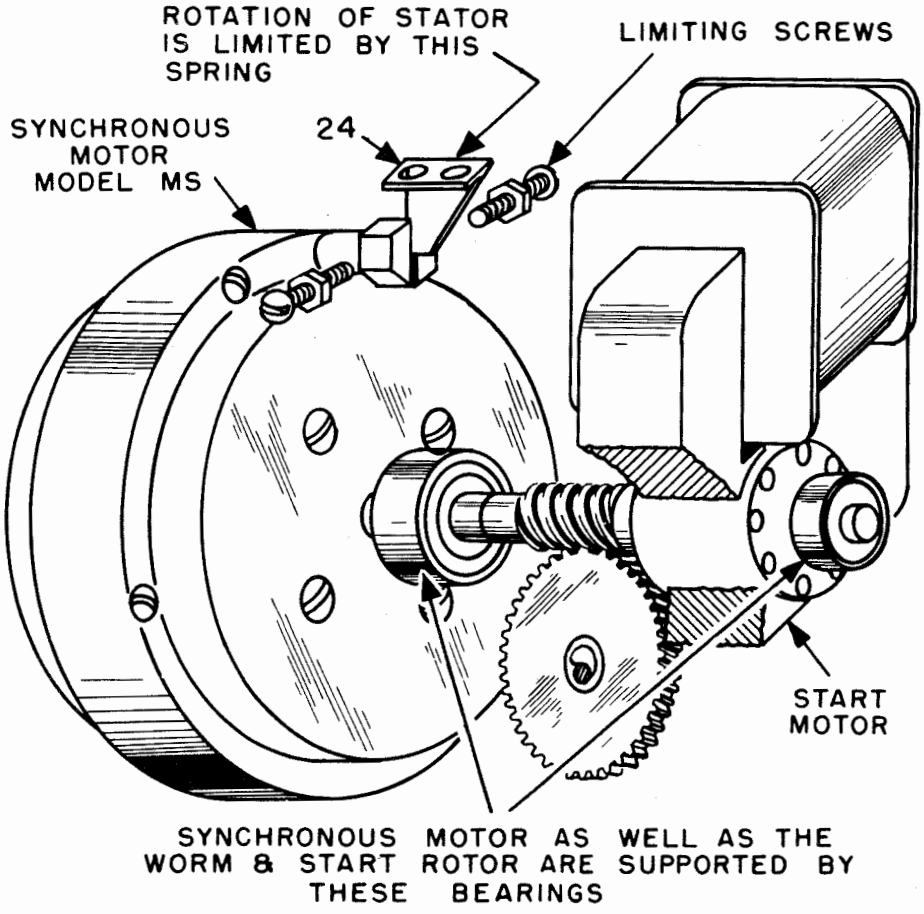


Figure 2–17. Synchronous Motor, Start Motor and Reduction Gear Assembly

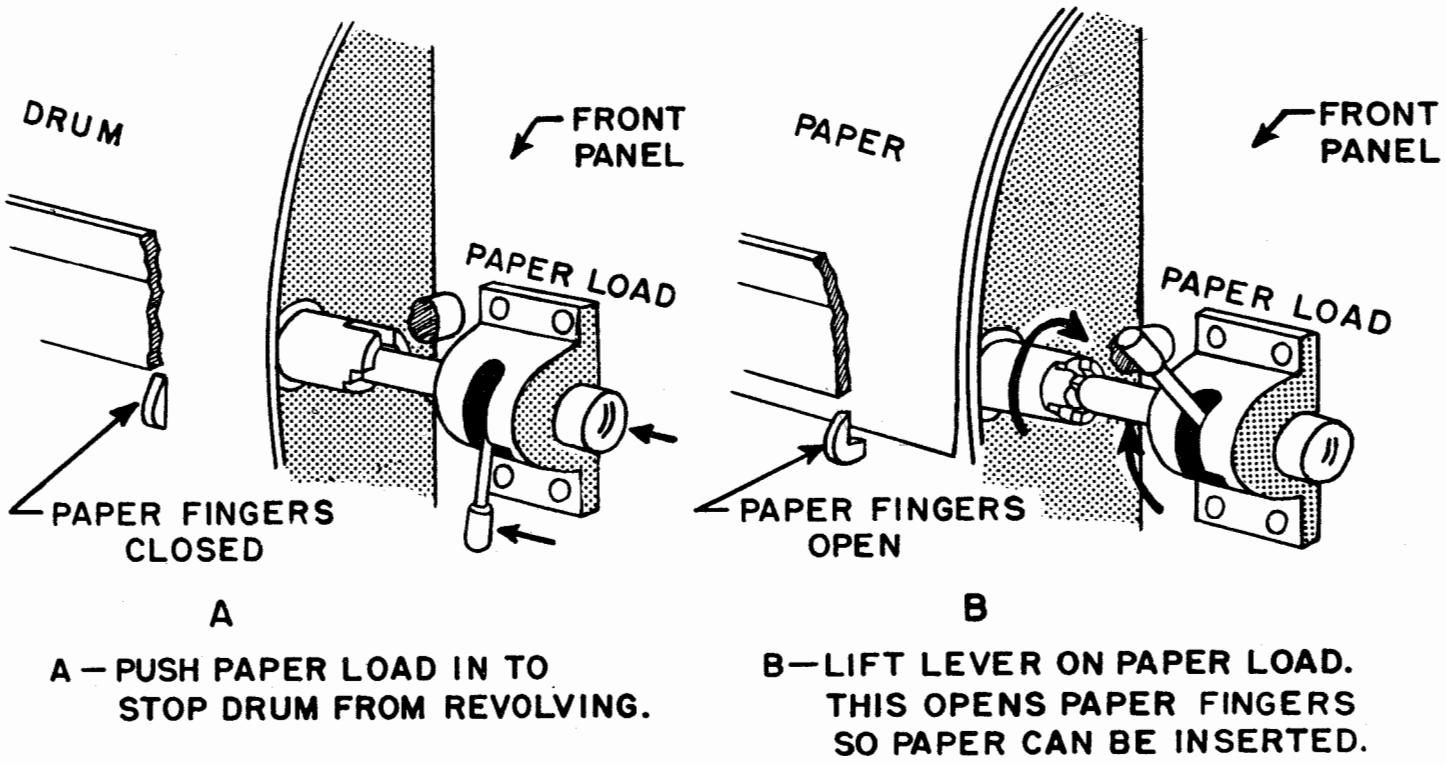


Figure 2–18. PAPER LOAD Operation

the right-hand end bell. This is locked in place by a single screw.

The paper clamp consists of five spring-loaded fingers which grasp the paper on the leading edge. These fingers are operated by rotation of a bar which protrudes from the right edge of the drum. This bar is engaged by the PAPER LOAD mechanism on the panel of the recorder subassembly, to mechanically stop the drum and lift the fingers for removal of copy and reloading fresh paper. The trailing edge of the recording paper is held tight against the drum by a brush located underneath the drum.

f. LEADSCREW SHAFT GEARING SYSTEM.—The leadscrew shaft which moves the carriage assembly is a stainless steel screw with ten threads per inch, rotated at a speed of 6¼ rpm through a gear system driven by the drum shaft. A reduction of 9.6 to 1 is provided by a three-step gear system. A thrust spring on the right-hand gear box cover removes the end play of the leadscrew shaft.

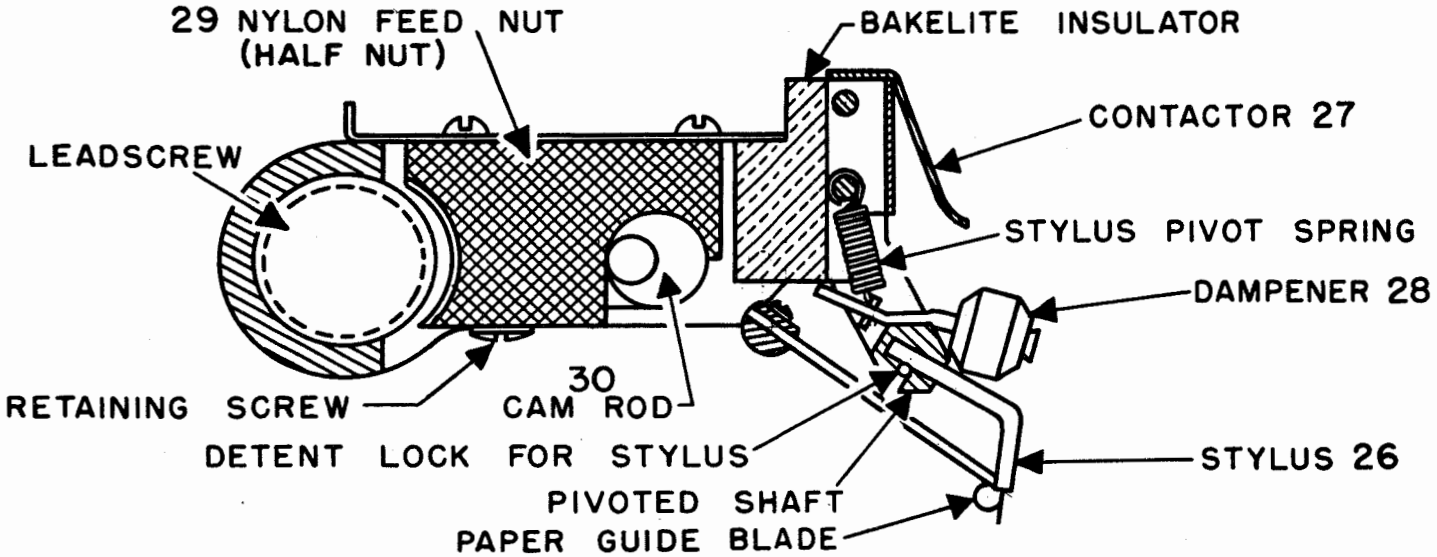


Figure 2–19. Detail of Stylus Carriage

g. CARRIAGE ASSEMBLY AND RETURN SPRING. *(See figure 2–19).* The stylus needle is held in the carriage assembly, which moves across the drum when engaged with the leadscrew shaft geared to the drum. The carriage is pulled to its starting position, at the left-hand side of the drum, by a nylon string which winds on a spring-actuated drum similar to the type used in typewriters.

The stylus needle detents into a pivoted holder, spring actuated to provide a fixed pressure of the needle against the recording paper. A dampener (28), located directly above the stylus needle, prevents excessive bounce of the needle when it passes over the trailing edge of the recording paper. A bakelite finger, located besides the stylus needle, holds down the trailing edge.

Contactor (27), mounted above the stylus, rides on a trolley rod to supply recording power to the stylus needle. The complete stylus head and trolley-rod are insulated, with the ground return of the recording circuit completed through the recording paper to the drum. When the stylus carriage is lifted from the recording position by the control mechanism, the contactor is disconnected from the trolley-rod and the stylus is raised from the drum. At the same time, switch S6 in the right-hand gear box disconnects the signal from the trolley-rod.

h. STYLUS CARRIAGE CONTROL MECHANISM. —*(See figures 2–19 and 2–20).* Within the stylus carriage is a nylon feed nut or half nut (29) that engages the leadscrew when actuated by the cam rod (30). Pressing the RECORD button turns the cam rod to engage the half nut against the leadscrew. When the carriage reaches the end of its travel, it is automatically disengaged from the leadscrew through the action of the trigger-operated latch (31 of figure 2–20). The latch (31) may also be operated by the electro-magnet of the carriage release actuator, which is energized when the PAPER LOAD control is operated to stop the drum or when the selector switch is turned from the RUN position.

Figure 2–20 shows the mechanism for actuating the cam rod to engage or disengage the stylus carriage. The spur gear (33) on the end of the cam rod meshes with the rack (34). The rack is supported on the rack-and-latch rod (35) which extends through the front panel as the RECORD button. When the RECORD button is pushed in as far as it will go, the latch assembly engages detent (36) in rod (35) and compresses the load spring (37). Spur gear (33) turns and rotates the cam rod to engage the half nut on the stylus carriage with the leadscrew and drop the carriage into place for recording.

Trigger (32), on the trigger-operated latch, projects through the gear housing so that it can be pushed by the stylus carriage at the end of travel to release the latch. Rod (35) then snaps back to its normal position and rotates the cam rod to disengage the half nut and lift the stylus from the paper.

The longitudinal movement of rack (34), which is fitted freely to rod (35), is restricted at one end by

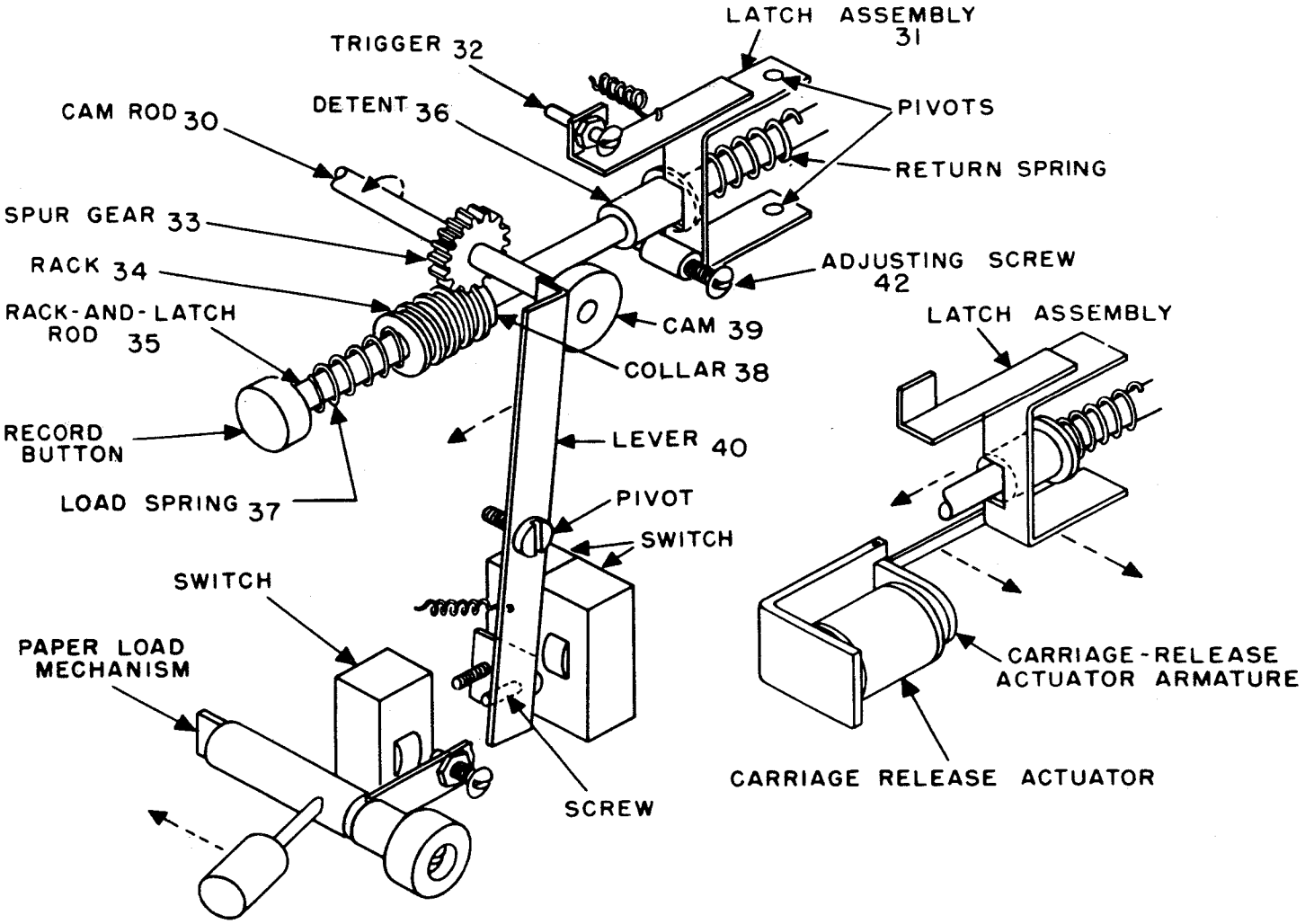


Figure 2–20. Stylus Carriage Control Mechanism

collar (38) and at the other end by load spring (37). If the RECORD button is pressed at a time when the half nut cannot drop into the threads of the leadscrew, rod (35) slides through the rack depressing the load spring and becomes latched in position by the normal action of the latch assembly. When the leadscrew shaft rotates to a position that permits the half nut to fall into place, the load spring pushes the rack up against collar (38) and rotates the cam rod to the proper position.

A limiting screw, located on the drum side of the right-side gear box, controls the depth of engagement of the half nut in the threads of the leadscrew by limiting the rotation of the cam rod. Cam (39) is placed at the end of the cam rod to actuate lever (40) and operate switches S6 and S8, which control the signal to the stylus needle. The lever is spring loaded against the cam and stroke adjustment is provided by limiting screws at the switch end.

The RECORD button releases automatically, disengaging the carriage and lifting the stylus, under the following conditions:

(1) At the end of travel of the stylus carriage, through action of the trigger-latch assembly.

(2) When the PAPER LOAD control is operated while selector switch is in RUN position. Switch S7 on the PAPER LOAD mechanism closes a circuit to operate the carriage release actuator.

(3) When the selector switch is turned from RUN to SYNC. Contacts on the selector switch close to complete a circuit to operate the carriage release actuator.

5. TEST PROCEDURES.

Two methods are built into the Facsimile Recorder RD–92A/UX for quickly locating circuit troubles. Neon light indicators are connected across each tube heater and across the high B+ fuse. A CIRCUIT TEST switch, used in conjunction with the front panel meter, provides a means for quickly checking the basic circuits at each of eleven test positions.

a. NEON LIGHT INDICATORS.—When a neon light connects across a circuit element it does not indicate as long as that circuit element continues to operate. However, when the circuit element, such as a fuse or tube heater, burns out, an open circuit develops, current ceases to flow through that element, and the open circuit voltage appears across the neon tube indicator paralleling the element that has burned out. This causes the neon tube to light up. A resistor in series with the neon tube limits current through the indicaor.

Where a number of circuit elements, such as tube heaters, connect in series, it is possible for two or more heaters to burn out at the same time. This condition, however, is very unlikely, since the circuit is opened as soon as the first tube burns out and the load immediately removed from the other tubes. In the event that there are two burnouts simultaneously, the neon tubes across the defective heaters do not light up. It is then necessary to test for the open heaters with a continuity checker, such as an ohmmeter.

b. CIRCUIT TEST SWITCH.—*(See simplified schematic, figure 2–15).* CIRCUIT TEST switch S4, enables a quick circuit check at eleven test positions with the use of meter, M1, as indicator. To obtain comparable readings, it is necessary to specify normal operating conditions for the test. For the RD–92A/UX, for all test positions except PHASE AMP and PRINT, the normal meter reading is 100 when the synchronous motor is running in SYNC position and the DENSITY control is at the TEST SIGNAL position. Each test position is checked as follows:

(1) POWER.—In this position, the line voltage available at the recorder is measured ahead of the power switch. A reading of 100 on the meter indicates a normal voltage of 117 volts on the power line.

(2) SIG AMP OUT.—To obtain the proper reading in this position, the DENSITY control is adjusted for maximum signal if a facsimile signal is being received or, if no signal is received, the control is rotated to TEST SIGNAL position. The meter reading is an indication of the amount of d-c signal available at the output of the signal amplifier unit for keying the modulator tube V202A. With no input or test signal, the meter reading should be about 45.

(3) PHASE AMP OUT.—For proper reading in this position, the DENSITY control must be adjusted for maximum signal and phasing pulses must be received. When PRESS TO TEST and PHASE switches are both depressed and the phasing thyratron V203 is functioning properly, the meter pointer will pulse upward once each second.

(4) LO B+.—In this position, the B+ voltage for the signal amplifier is measured. If the meter reads 100 in POWER position and does not read 100 in LO B+ position, selenium rectifier CR4 or capacitor C7 or C8 may be defective.

(5) HI B+.—In this position, the B+ voltage applied to the phase, synchronous motor, and print amplifiers is measured. The meter should read about 100 when the synchronous motor is running. If the meter reads 100 in the POWER position and does not register near 100 in HI B+ position, rectifiers CR1, CR2 and CR3 or capacitors C5, C6, or C8 may be defective.

(6) SYNC DRIVE.—This position measures the signal applied to the grids of the motor amplifier tubes V2 and V3. The meter reading may vary widely from 100, depending on the setting of the SYNC MA potentiometer at the back of the recorder. An exceptionally low reading may be caused by a defective tube — V1, V301, or V302.

(7) PRINT.—For this test, DENSITY control is adjusted for maximum signal input and the stylus engaged so that copy is being printed on the recording paper. Under steady state maximum signal, the meter should read about 100. If the reading is exceptionally low, the fault may be a defective tube — V4, V201, or V202.

(8) OSC.—This position measures the voltage output of the 15 kc oscillator. A meter reading considerably less than 100 may be caused by a defective tube — V201 or V1.

(9) SIXTY-CYCLE MOTOR. — This position measures the voltage applied to the start or run motor. This voltage is regulated by voltage regulator tube V6 and should give a reading of nearly 100 in the SYNC or RUN position of the selector switch. If the reading is not near 100, tube V6 may be defective. In STAND-BY or START position, the reading should be high since the motors are not drawing current.

(10) VR75.—This position checks the voltage regulator VR75/OA3. If the meter does not read approximately 100, tube V5, or capacitors C7 or C8 may be defective.

(11) SYNC MA.—This position checks the d-c current through the synchronous motor. The meter should read between 85 and 100 with the synchronous motor running and may be adjusted by means of the SYNC MA control at the rear of the recorder. If a reading higher than 85 cannot be obtained, tube V2 or V5 may be defective.

SECTION 3
INSTALLATION

1. UNPACKING.

Take care when unpacking or handling the equipment. It may be damaged when not protected by the packing case. Do not discard the shipping container and inside packing material. Store them for future use.

Unpack the facsimile recorder as follows: *(See figure 3–1).*

a. Cut the steel straps with a suitable cutting device or twist with pliers until the straps crystallize and break.

b. Remove the nails with a nail puller and lift off the top of the shipping container. Do not pry with a crowbar or other tool.

c. Remove the packaging material as follows:

(1) Tear open the heavy waterproof paper.
(2) Open the flaps on the first cardboard box.
(3) Tear open the hermetically sealed foil.
(4) Open flaps on the second cardboard box.
(5) Remove all cardboard fillers from second cardboard box.

d. Lift recorder from the container and place on a prepared table or bench.

e. Place inside packing material in the shipping container and store for future use.

2. INSTALLATION *(see figure 3–2).*

a. LOCATION.—The following factors should be considered when selecting the permanent location for the recorder.

(1) WEIGHT.—The weight of the recorder is approximately 75 pounds. Make certain that the table or bench will sustain the weight.

(2) SPACE.—Be sure that the space allocated allows for sliding the recorder in and out of its cabinet.

(3) VENTILATION.—Adequate ventilation must be available.

(4) POSITION.—The recorder must be placed in

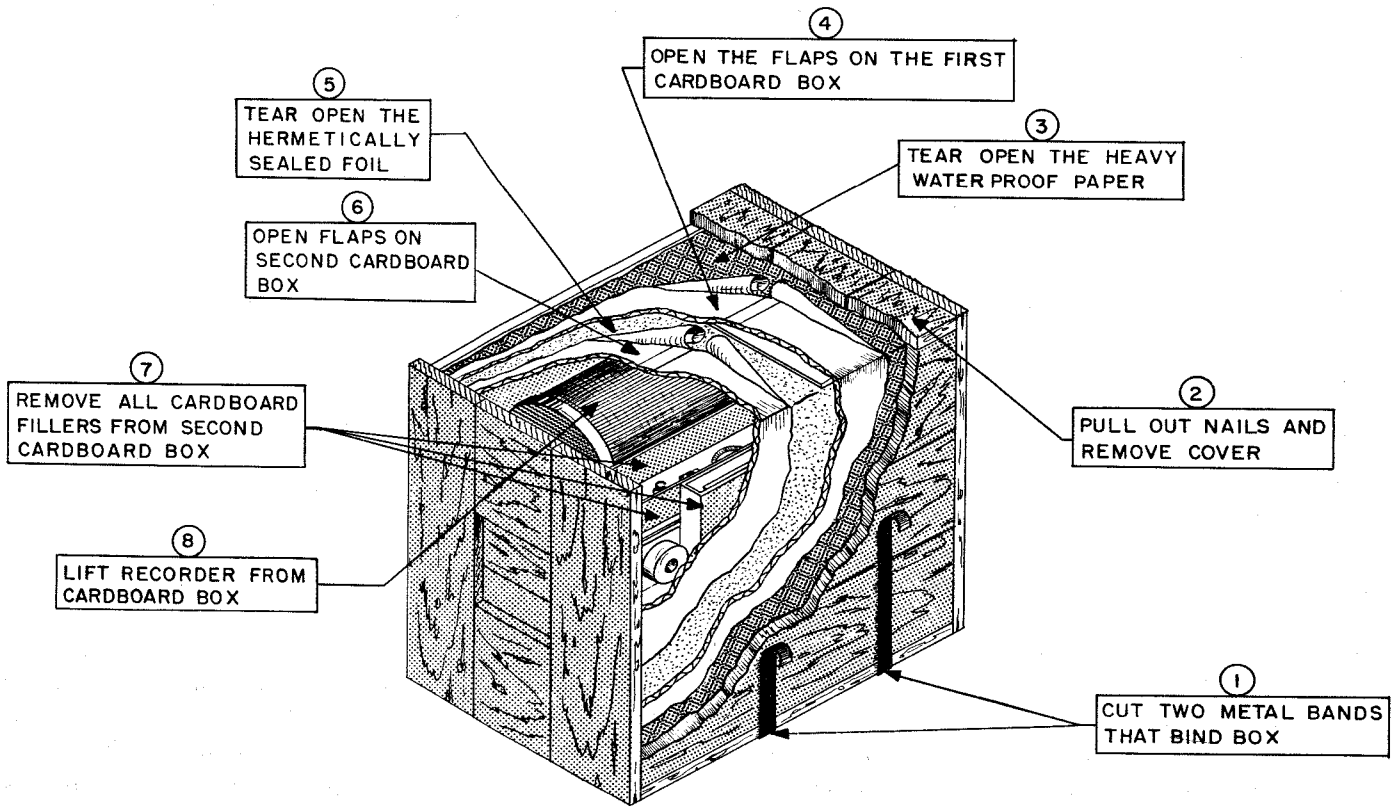


Figure 3–1. Unpacking Facsimile Recorder RD–92A/UX

a position such that the front panel controls are immediately available.

b. MOUNTING.—Facsimile Recorder RD–92A/UX may be mounted either on its shock mounted cabinet on a table or in a standard Navy relay rack, such as CY597/G.

(1) CABINET MOUNTING. — For cabinet mounting proceed as follows:

(a) Remove the shipping chock screws located in the rear of the unit.

(b) Loosen the four knurled screws on the front panel and pull the recorder forward about 8 inches.

(c) Remove the leads at the INPUT terminals and the ground post, located at rear of chassis. Disconnect the twist-lock power plug by turning the plug counter-clockwise and pulling it out. *(See figure 3–3).*

(d) Pull the latches on the slides to the front and remove the recorder from its cabinet.

(e) Examine the tubes and capacitors for damage.

(f) Mount the shock mounted cabinet as indicated in figure 3–2, detail A and B. Allow about 3 feet in front of the cabinet for service and maintenance.

(g) Power and input signal leads must be available at the rear of the cabinet. Remove the plate from the rear of the cabinet and drill the necessary holes for cable fittings to allow the power, ground, and input signal leads to enter.

(h) Connect the input signal lines to the terminals marked INPUT on the barrier strip. If the input line is unbalanced, place a jumper between the cold side of the line and the terminal marked GND. Shields on signal leads, if used, should be connected to GND terminal.

(i) Connect a-c power to the terminals marked 115 VOLTS AC.

(j) Connect a lead from a known ground point to the terminal marked GND.

(k) Replace the recorder in the cabinet, connect the input signal and ground leads from the cabinet to the recorder, and insert the power twist-lock connector.

(l) Slide the recorder into the cabinet and tighten the knurled panel screws.

(2) RELAY RACK MOUNTING. — Proceed as follows in mounting the recorder in a relay rack such as CY597/G.

(a) Remove the recorder from its cabinet as in steps *(a), (b), (c)* and *(d),* for cabinet mounting.

(b) Remove the slide roller assembly from the recorder cabinet by removing the four Phillips-head screws in front, slightly bending the two side supports to the center and pulling the assembly out of the cabinet.

(c) Mount the slide roller assembly in the relay rack using the same Phillips-head screws.

(d) Slide the recorder part way into the slide roller assembly and connect the input signal leads to the terminal marked INPUT. Use the removable power cord with the Hubbell twist-lock connector to supply the a-c power to the unit. Connect a wire from a known ground point to the ground terminal.

(e) Slide the recorder into the rack and fasten the four knurled front panel screws.

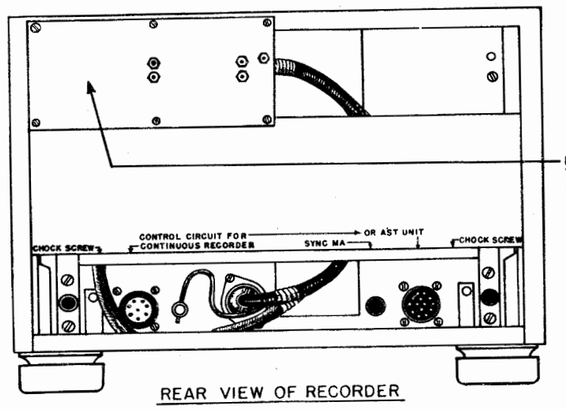
c. CONNECTION TO TRANSMISSION CIRCUIT. —Facsimile signals can be received over a transmission circuit for at least as great a distance as voice signals; however, some circuit requirements are more severe for facsimile than for voice transmission. For best results, the circuit should have a frequency response flat within 2db between the frequency limits of 900 and 2,700 cycles with a total delay distortion not exceeding 500 microseconds. Where the transmission circuit has a flat frequency response between 900 and 1,800 cps or between 1,800 and 2,700 cps, fairly good results are still obtained. For high quality reception, the transmission circuit must be free from noise. However, readable copy will be obtained when the peak noise is considerably higher than the facsimile signal level.

(1) WIRE LINES.—The wire line circuit used should be free of amplitude variations and reflections. "Schedule one" or "Schedule two" AT&T lines are recommended for fixed land installations. Conventional voice circuits are satisfactory for distances of less than 100 miles.

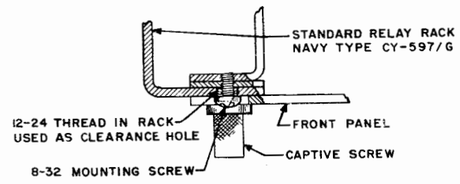
When used with wire lines, connect the recorder INPUT terminals directly to the line. No external coupling transformer is required.

(2) RADIO CIRCUITS.—The radio circuit selected should be free from interference and multipath transmissions. If facsimile signals are received from an FM radio circuit, a short haul AM radio circuit with no fading, or a microwave radio relay, an auxiliary converter is not required. The radio circuit output is connected directly to the INPUT terminals of the recorder. It may be necessary to connect a resistance pad between the radio receiver output and the facsimile recorder input to keep the signal level to the recorder at no more than 0.7 volts.

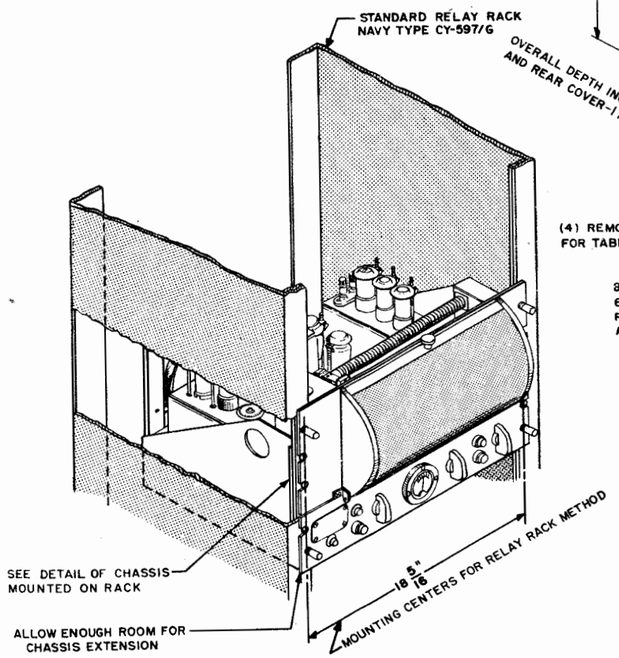
When used to record facsimile signals from radio circuits, the type of modulation determines the auxiliary equipment required. This may be amplitude modulation (AM) or frequency modulation (FM) giving a conventional audio output, audio frequency shift modulation (AFS), or radio carrier frequency shift modulation (RFS).



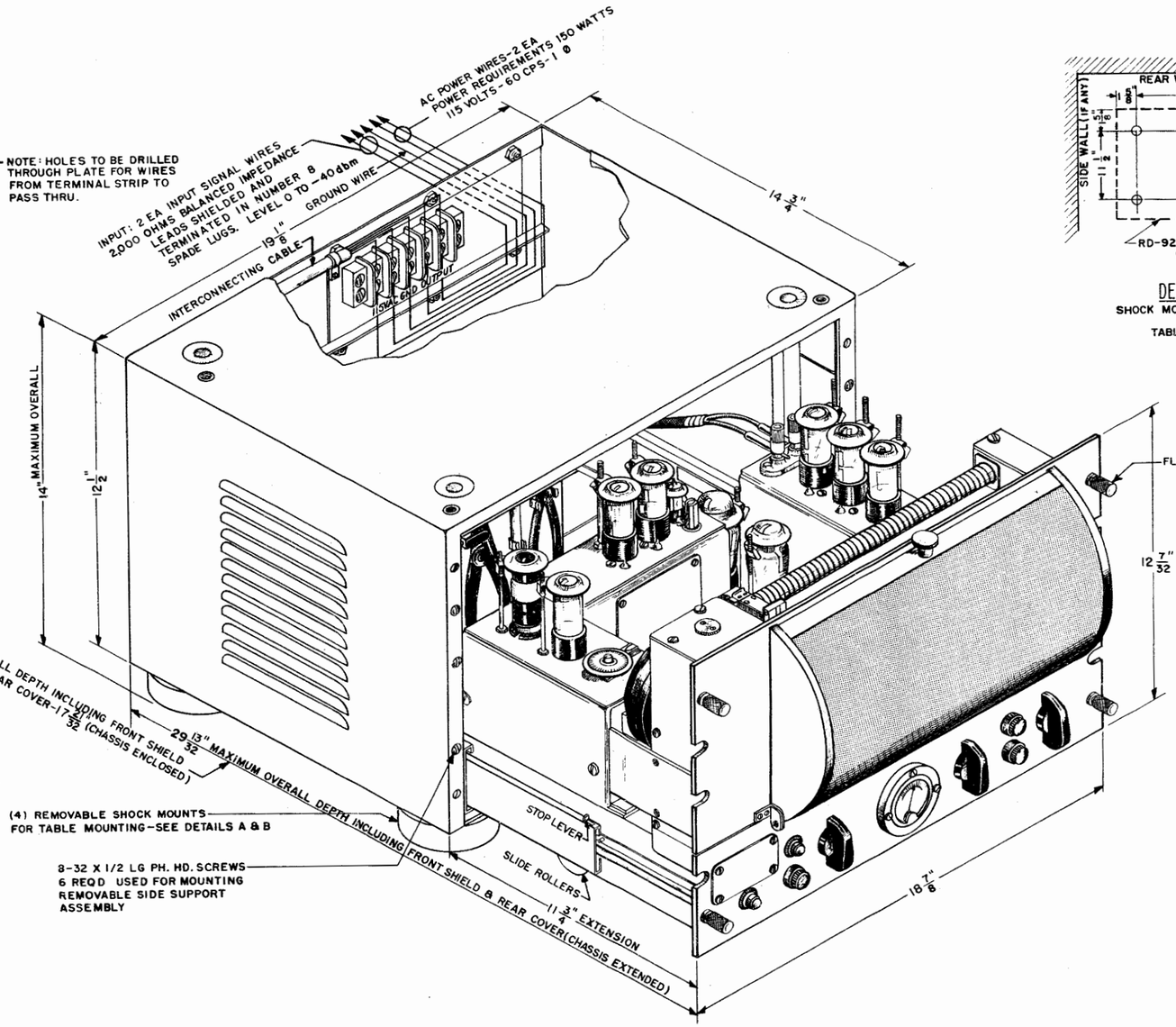
REAR VIEW OF RECORDER

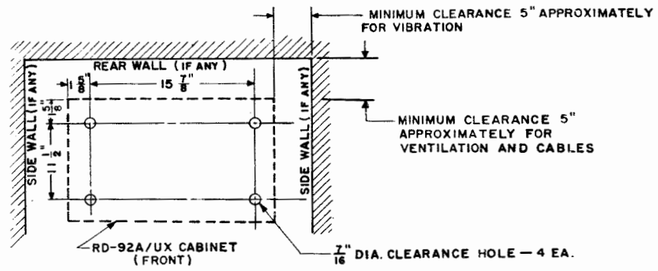


DETAIL OF CHASSIS MOUNTED IN RACK

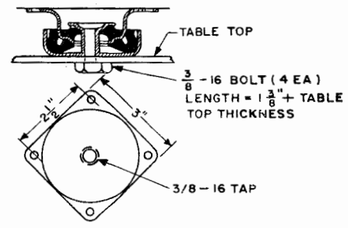


ASSEMBLY OF CHASSIS MOUNTED IN RACK





DETAIL A
SHOCK MOUNT LOCATIONS FOR TABLE METHOD



DETAIL B
SHOCK MOUNT BOLTING TABLE METHOD

POWER REQUIREMENTS

115 VOLTS - 60 CPS - 1 Ø - 150 WATTS

TUBE COMPLEMENT

3 - 1635
1 - 2D21
1 - 2H20
1 - 6-36
1 - 6AG7
2 - 6SL7
5 - 6SN7
1 - VR75/0A3

WEIGHT

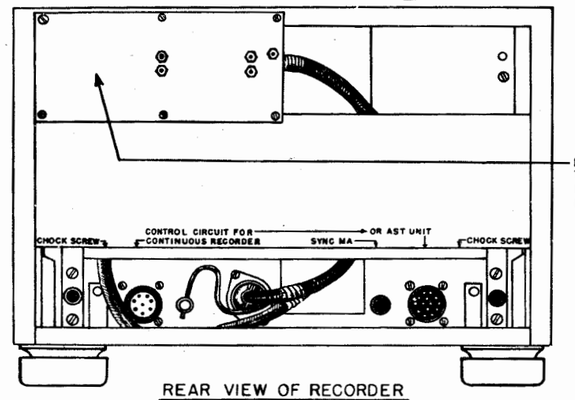
UNCRATED 75 LBS
CRATED 130 LBS

CUBIC CONTENT 4720 CU. IN.

EQUIPMENT SPARES

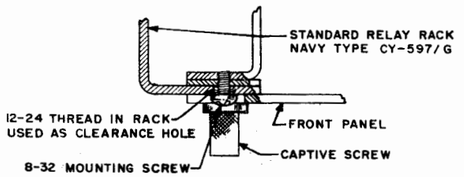
1 BOX 12"x9"x6"
CUBIC CONTENT 648 CU. IN.
WEIGHT
UNCRATED 30 LBS
CRATED 40 LBS

Figure 3–2. Details of Installation

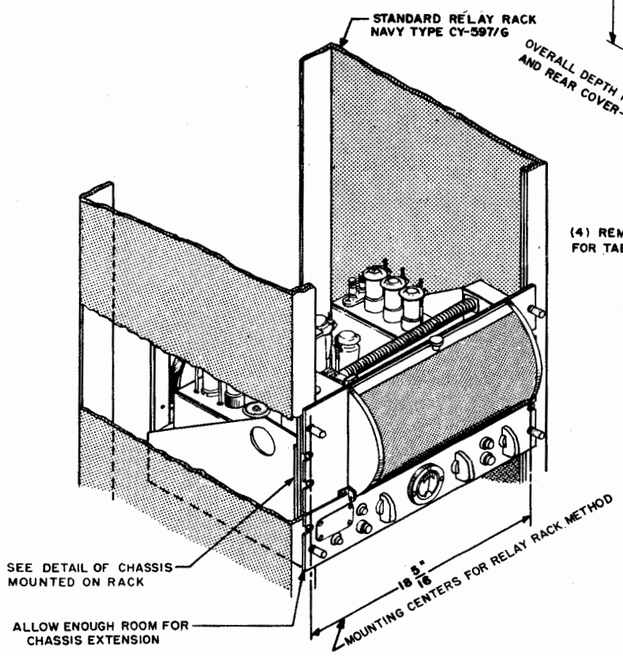


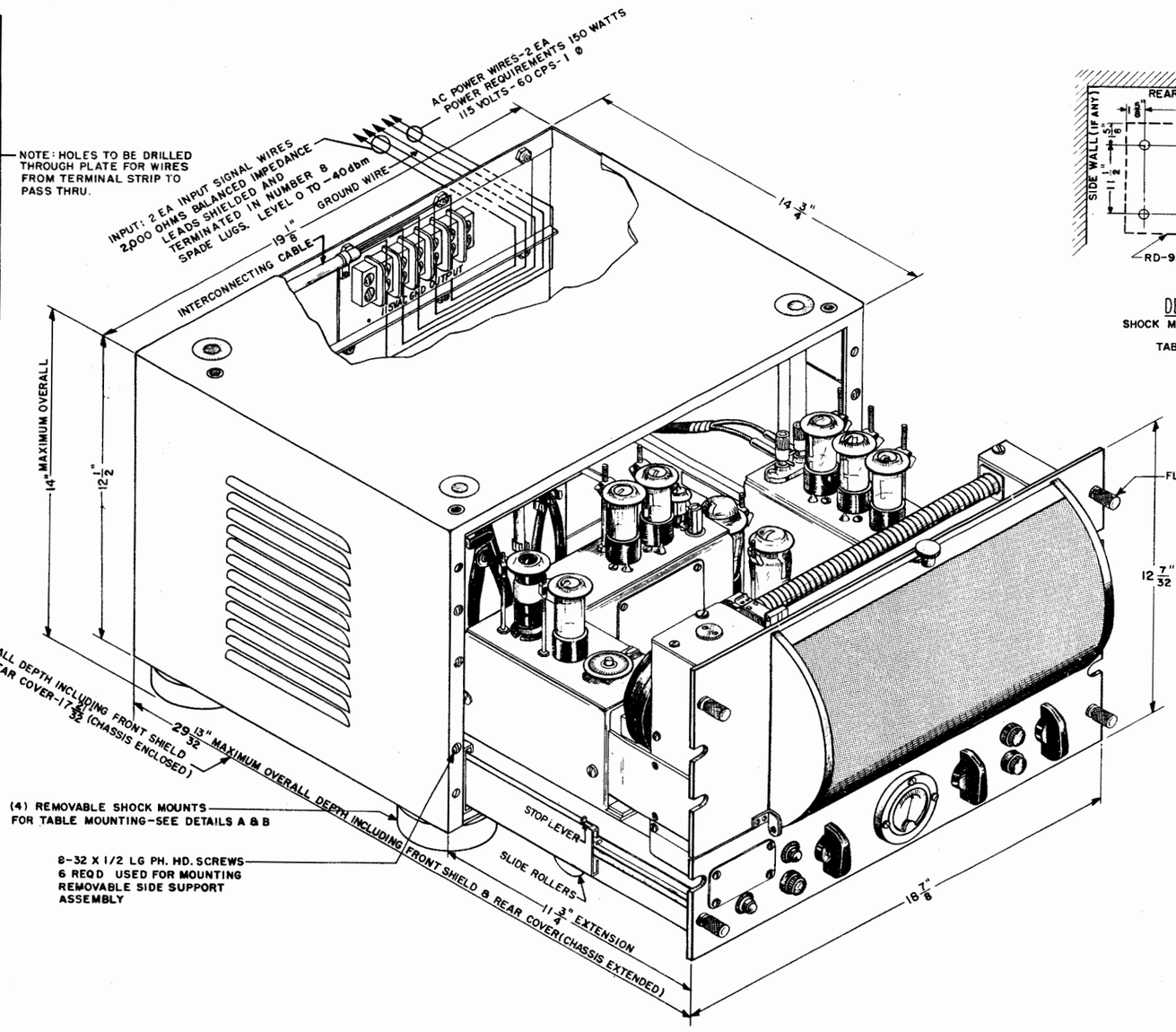
NOTE: HOLES TO BE DRILLED THROUGH PLATE FOR WIRES FROM TERMINAL STRIP TO PASS THRU.

REAR VIEW OF RECORDER

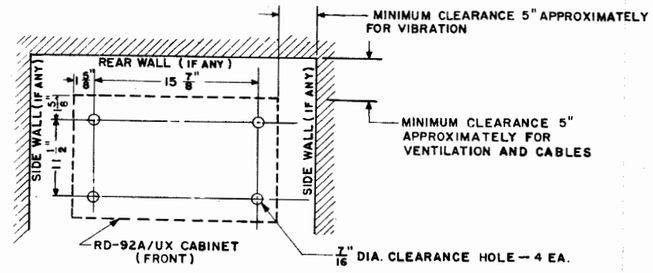


DETAIL OF CHASSIS MOUNTED IN RACK

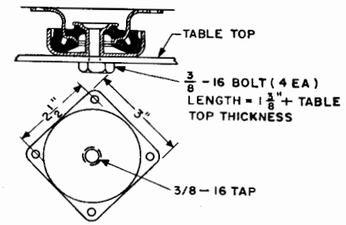




ASSEMBLY OF CHASSIS MOUNTED IN RACK



DETAIL A
SHOCK MOUNT LOCATIONS FOR TABLE METHOD



DETAIL B
SHOCK MOUNT BOLTING TABLE METHOD

POWER REQUIREMENTS

115 VOLTS - 60 CPS - 1 Ø - 150 WATTS

TUBE COMPLEMENT

3 - 1635
1 - 2D21
1 - 2H20
1 - 6-36
1 - 6AG7
2 - 6SL7
5 - 6SN7
1 - VR75/0A3

WEIGHT

UNCRATED 75 LBS
CRATED 130 LBS

CUBIC CONTENT 4720 CU. IN.

EQUIPMENT SPARES

1 BOX 12"X9"X6"
CUBIC CONTENT 648 CU. IN.
WEIGHT
UNCRATED 30 LBS
CRATED 40 LBS

Figure 3-2. Details of Installation

(a) AMPLITUDE OR FREQUENCY MODULATION.—When receiving facsimile signals from a conventional AM or FM receiver, connect the 500-ohm output of the radio receiver directly to the INPUT terminals of the facsimile recorder. If the radio receiver has no 500-ohm output, use the lowest output impedance available.

(b) AUDIO-FREQUENCY SHIFT MODULATION.—When receiving AFS, the 500-ohm output of the radio receiver connects to the INPUT terminals of auxiliary equipment, Frequency Shift Converter, CV–172( )/U. Connect the output from the converter to the INPUT terminals of the facsimile recorder.

(c) RADIO CARRIER FREQUENCY SHIFT MODULATION. — When receiving RFS, Frequency Shift Converter, CV–172( )/U, is used. Additional auxiliary equipment may be required.

d. CONNECTION FOR AUTOMATIC PHASING AND STARTING.—In an installation providing for *start* signals from the facsimile transmitter, Automatic Start and Transfer Unit AST–( ) may be used. This equipment is a relay rack mounted unit using a 5¾ inch panel, or it may be mounted between two RD–92A/UX recorders which are in their cabinets by using special side plates provided with the unit.

The Automatic Start and Transfer Unit has its own self-contained power supply and operates from the 115-volt, a-c power line. Two interconnecting cables fasten to the rear of the RD–92A/UX recorders.

3. INITIAL ADJUSTMENTS.

With the equipment completely installed, make the following checks and adjustments. If difficulty is experienced in obtaining the results specified, refer to the adjustments and corrective procedures indicated in Section 7—Maintenance.

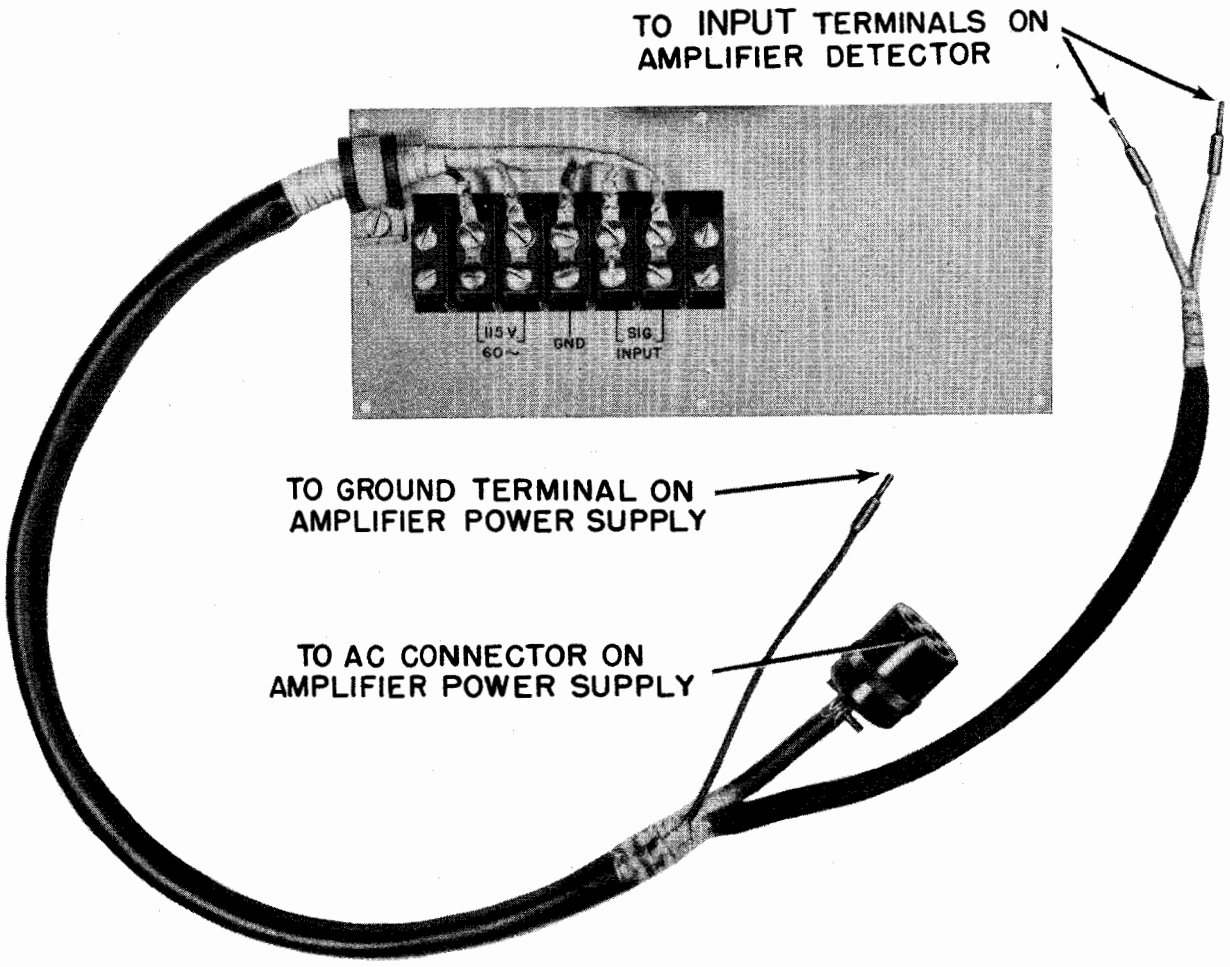


Figure 3–3. Input Terminals and Connector Cord

a. MECHANICAL INSPECTION.

WARNING

Be sure that the recorder is not connected to the power source when making mechanical inspection.

After installation and electrical connections are completed, make a thorough inspection of the equipment and its associated wiring. Check for:

(1) Any damage to the equipment.

(2) Any loose material, dirt, or lint. Wipe clean with a clean, lint free cloth.

(3) Any clogging of mechanical parts.

(4) Any loose wiring.

(5) Possible shorted wiring.

b. CHECK POWER CIRCUIT.—Proceed as follows:

(1) Turn the front panel selector switch to OFF position.

(2) Connect power to the recorder and turn on power source.

(3) Turn the selector switch to STANDBY position. Note that the pilot lamp lights.

(4) Turn CIRCUIT TEST switch to POWER position and operate the PRESS TO TEST switch. The front panel meter should read 100 if the power line voltage is normal, at 117 volts.

c. CHECK FUSES AND TUBES.—Proceed as follows:

(1) Loosen the four knurled front panel screws and pull the recorder forward on its slides. Note that all tube heaters are lit.

(2) Remove the two 2 AMP power fuses, one at a time, and note that the pilot lamp extinguishes.

(3) Turn the front panel selector switch to OFF. Remove retainers from tubes V202 and V102 and remove both tubes. *(See figure 5–1 for tube location.)*

(4) Turn the selector switch to STANDBY position. The heaters of V202 and V102 are connected in parallel; both have to be removed to open the series heater circuit. Note that the neon indicators next to the empty sockets are lit.

(5) Turn the selector switch to OFF and replace the tubes, clamping each in place with its retainer.

(6) Repeat steps (3), (4) and (5) for the following tubes in order, taking out one tube at a time: V1, V2 V3, V4, V7, V101, V103, V201, V203, and V301.

(7) Check the V302 heater indicator as follows:

(a) Turn the front panel selector switch to OFF position and remove the power source from the equipment.

(b) Take off the tube retainer and the bakelite cover, and remove V302.

(c) Turn on the power source to the equipment and turn the selector switch to STANDBY position. Note that the indicator next to the V302 socket is lit.

(d) Turn the selector switch to OFF position and remove the power source to the recorder. Replace V302, the bakelite cover and clamp the retainer in place.

d. CHECK MOTORS.—

(1) Turn the selector switch to STANDBY position and allow a warm up period of about one minute.

(2) Turn the switch to START position and note that the start motor is turned on. This is distinguished by a purring sound.

(3) Turn the selector switch to SYNC position and note that the synchronous motor is turned on. This is distinguished by a high pitched tone. The synchronous motor should fall into synchronism in this position.

(4) Turn the selector switch to RUN position. The recorder drum should rotate.

e. CHECK CARRIAGE RELEASE MECHANISM.—The carriage release mechanism can now be checked as follows:

(1) Depress the RECORD button until it locks in position.

(2) Push the PAPER LOAD lever to the left. The RECORD button should release to its unoperated position.

(3) Again depress the RECORD button until it locks in position.

(4) Turn the selector switch from RUN to SYNC position. The RECORD button should release to its unoperated position.

f. ADJUST SYNC MA CONTROL.—Adjust as follows:

(1) Turn the CIRCUIT TEST switch to SYNC MA position.

(2) Depress the PRESS TO TEST switch.

(3) Adjust the SYNC MA control at the rear of the recorder so that the front panel meter reads 100.

g. CHECK HI B+ FUSE.—Proceed as follows:

(1) Turn the selector switch to OFF position.

(2) Remove the 1/8 AMP B+ fuse.

(3) Turn the selector switch to SYNC position. The neon light indicator above the fuse should light.

(4) Turn the selector switch to OFF position.

(5) Wait until the fuse indicator extinguishes before replacing fuse.

h. CIRCUIT TEST CHECK.—Check the readings of all CIRCUIT TEST switch positions as outlined in Section 7.

SECTION 4
OPERATION

1. INTRODUCTION.

Facsimile Recorder RD-92A/UX is used to receive fixed images transmitted over an elcctrical communication system, such as wire or radio circuits. The operator must be sufficiently familiar with the communication system used to know that proper connection is made to the facsimile recorder, and when facsimile signals are being received. In most cases a monitoring speaker in the receiver, converter, or other auxiliary equipment gives audible signals to indicate reception of a facsimile transmission.

The operator must at all times keep the facsimile recorder in operating condition and ready for the reception of copy.

2. CAPABILITIES AND LIMITATIONS.

Facsimile Recorder RD–92A/UX was designed to make direct recordings of maps, sketches, typewritten and printed text, or handwriting, transmitted from TT41( )/TXC–1B types of facsimile equipment. Facsimile signals may be recorded from either wire or radio communications circuits.

The recorder was designed primarily for recording black and white copy. It records some halftone shadings, but these do not accurately represent the copy transmitted when it is a halftone photograph or picture. For this reason, Facsimile Recorder RD–92A/UX is not recommended for recording facsimile signals transmitted from photographic copy.

Delay distortion, frequency response characteristics, and other characteristics of the transmission medium may degrade the quality of the recorded copy. Interference and spurious signals may also affect the recording.

3. OPERATION OF FACSIMILE RECORDER RD–92A/UX.

(See Figure 4–1.)

On the front panel of the recorder is listed a brief resume of the operating instructions. Follow the instructions when operating the equipment. A more detailed explanation follows:

a. START EQUIPMENT.—Before starting the equipment for the first time, check with installation personnel to be sure that the recorder, and any auxiliary equipment, is completely installed and initial adjustments listed in Section 3 have been made. Then proceed as follows:

(1) Turn selector switch to STANDBY position. Note that the pilot light lights up, indicating that power is being applied to the recorder. Wait about one minute for the tubes to warm up. The recorder may be left at STANDBY while waiting for a transmission so that the set is ready for immediate operation.

(2) Turn selector switch to START position. Wait about 5 seconds for the start motor to bring the synchronous motor above synchronous speed.

(3) Turn selector switch to SYNC position. Wait until the synchronous motor coasts down and locks in synchronous speed. This is distinguished by the distinctive high pitched tone.

(4) If the motor does not lock in but falls through the synchronous speed, switch back to START position and repeat steps (2) and (3). If the motor does not come down to synchronous speed, turn to STANDBY and allow the motor to stop. Omit step (2) and switch directly to SYNC position.

(5) Turn selector switch to RUN position. It is necessary for the drum to rotate into proper position for loading paper.

b. LOAD PAPER.

(1) With the selector switch in RUN position, push PAPER LOAD lever to the left and hold there until the drum stops rotating. Then lift the projecting lever.

(2) Open the hinged cover over the drum. (*See figure 4–2.)*

(3) When the PAPER LOAD lever is lifted, the paper clamp fingers on the drum open. The PAPER LOAD lever remains in the up position. Drop a fresh sheet of recording paper into the space between the paper guide and the drum so that it rests up against the clamp fingers.

(4) Flip down the PAPER LOAD lever. This causes the fingers to close quickly and grab the paper. This action also releases the drum, which quickly picks up speed to the synchronous speed of 60 rpm.

(5) Close the hinged cover.

c. ADJUST DENSITY CONTROL.—This adjustment controls the gain of the signal amplifier so that the proper d-c voltage is obtained to key the print oscillator signal. Incorrect setting of the DENSITY control may result in faulty recording.

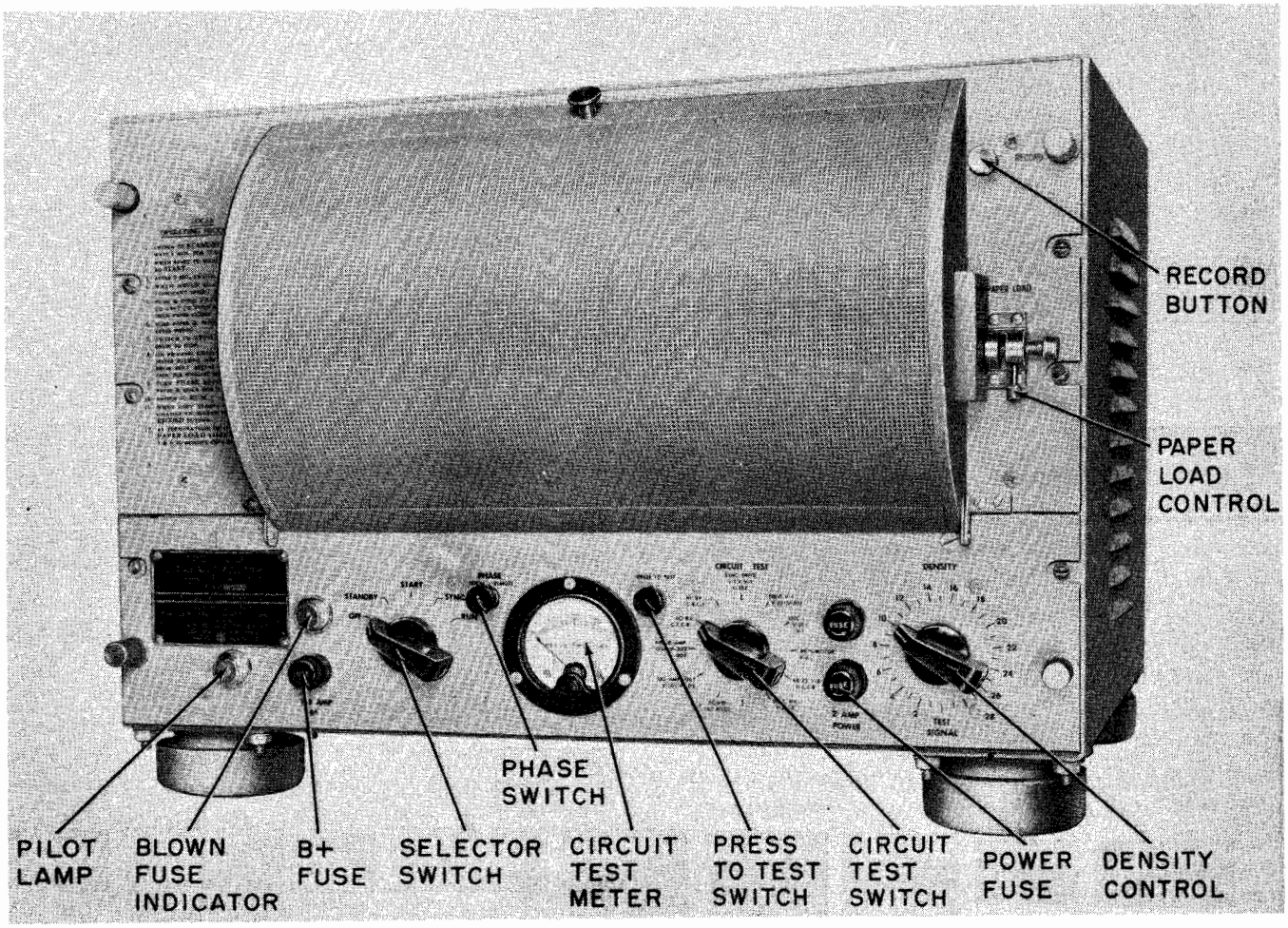


Figure 4–1. Control Panel

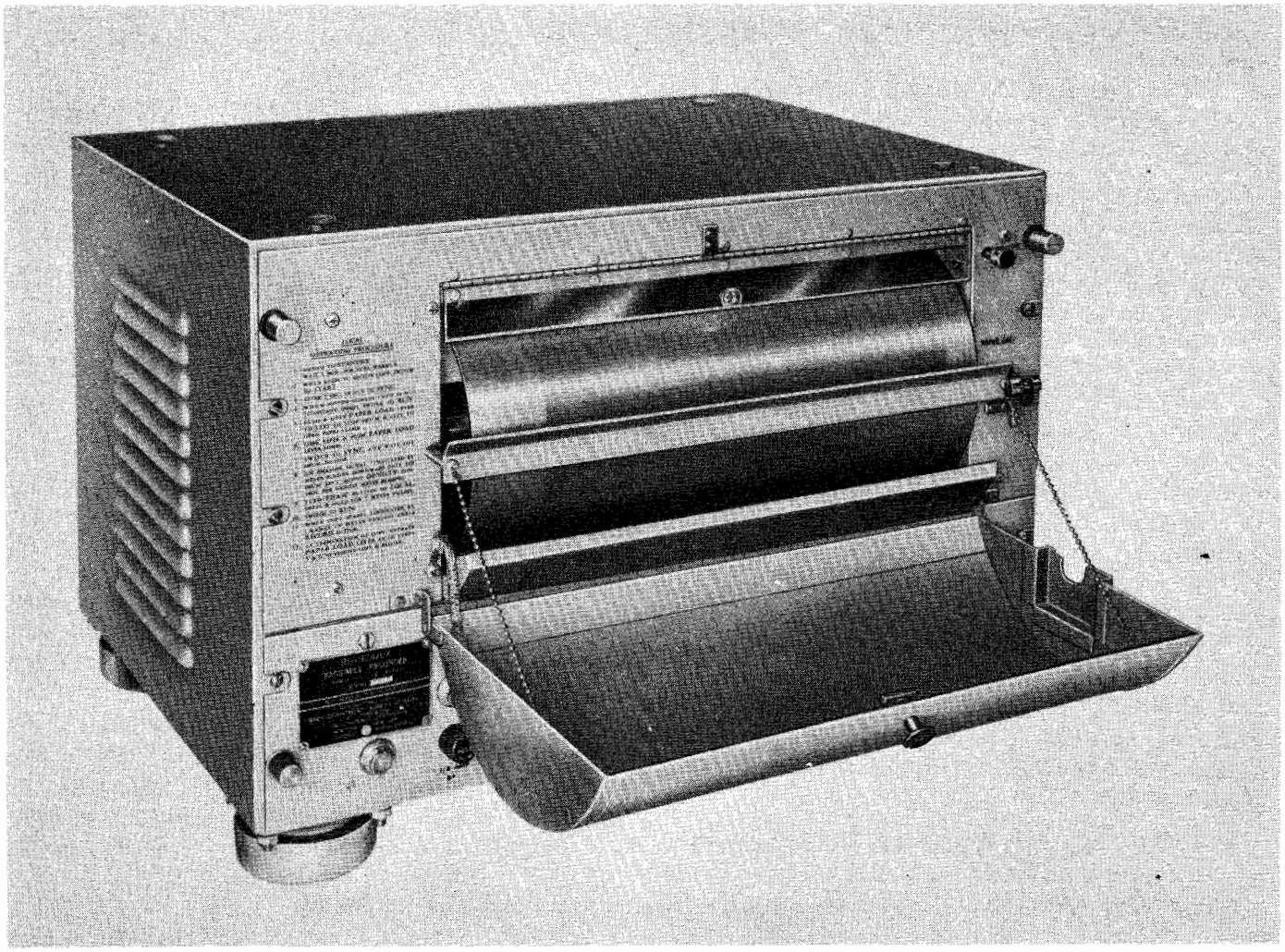


Figure 4–2. Recorder With Drum Cover Opened

(1) Set the DENSITY control when facsimile signals are being received. When steady signals of maximum signal level are received, preferably on phasing signal, start near zero and advance the control to the lowest point that gives maximum reading on the meter on the front panel. This reading is normally about 100.

(2) In some types of copy it is desirable to advance the dial setting of the DENSITY control slightly beyond the point that gives maximum meter reading. Try this procedure if the recorded copy is too light.

(3) Leave the DENSITY control at the setting that gives best recording.

d. PHASE RECORDER.—The phasing operation is performed with the recorder drum stationary. Phasing pulses may be identified by a downward dip of the meter pointer occurring once a second.

(1) Switch to SYNC position and wait for drum to stop.

(2) Turn PHASE button to LOCAL.

(3) When phasing pulses are received, depress PHASE button and hold depressed for five pulses. While phasing, two clicks per second are usually heard; one when the phasing actuator trips and another when the stop bar passes the drum drive coupler.

(4) Turn selector switch to RUN position. The drum will rotate in the properly phased position.

(5) Press RECORD button when the copy starts. This is indicated by a change in meter pulses. Usually, the meter reading drops down to about zero and flicks upward instead of downward.

The stylus now feeds across the drum to print the copy, and releases automatically at the end of travel.

If it is desired to take less than a complete copy, release the stylus by:

(*a*) turning selector switch from RUN to SYNC position, or

(*b*) operating the PAPER LOAD lever.

The stylus returns automatically to the left-hand end of the drum when it is released.

e. RELOAD PAPER.—When the recorded copy is removed from the drum at the end of a run, it is convenient to load up with a new sheet of paper to prepare the recorder for the next transmission. Operate PAPER LOAD lever as in *b.,* steps (1) to (5).

4. OPERATION FOR REMOTE PHASING AND STARTING.

Remote phasing and starting of the facsimile recorder is provided in installations that include an Automatic Start and Transfer Unit, Model AST–( ), usually with two recorders.

Operating instructions which apply specifically to the AST unit are printed on the front panel of that unit. The AST unit contains a monitor amplifier and speaker, so that voice announcements and facsimile signals coming in on the communications line may be heard.

a. INSPECT INSTALLATION.—Check installation to be sure that AST unit connects properly to the facsimile recorders and the communications line. See Section 3, par. 2 *d.*

b. TURN ON EQUIPMENT.—Turn on both the AST unit and the facsimile recorders.

(1) Turn on the AST unit as specified on front panel of units.

(2) Turn on facsimile recorders and adjust for operation as specified on special operating plate provided with the AST unit. This is similar to LOCAL operation, except that phasing and starting operations are omitted.

(3) Load paper on facsimile recorders and leave selector switches at RUN position and PHASE buttons depressed at REMOTE position. The facsimile recorders are now set for automatic phasing and starting from signals from the facsimile transmitter.

c. RELOAD PAPER.—Check periodically at from 20 to 40 minute intervals to reload paper, if required.

5. OPERATOR ADJUSTMENTS.

Only two control adjustments are to be made by the operator. These are adjustment to the DENSITY control and the SYNC MA control.

a. DENSITY ADJUSTMENT.—Adjust Density control as outlined in 2 *c,* steps (1) to (3), this Section.

b. SYNC MA CONTROL ADJUSTMENT.—Adjust SYNC MA control as outlined in Section 3, paragraph 3 *f,* steps (1) to (3).

6. SUMMARY OF OPERATION.

A summary of operation of the Facsimile Recorder RD–92A/UX is printed on the front panel of the unit, as shown below.

1. Switch to STANDBY.
   Wait 1 minute for tube warmup.
2. When ready to receive copy, switch to START.
3. After 5 seconds, switch to SYNC.
4. When motor coasts into SYNC, (constant speed) switch to RUN.
5. Push and hold PAPER LOAD lever to left to stop drum and lift to open paper clamp.
6. Load paper and push PAPER LOAD lever down.
7. Switch to SYNC, and wait for drum to stop
8. On phasing signal (indicated by meter pulsing downward once per drum rev.) adjust DENSITY control for highest meter reading.
9. Turn PHASE button to LOCAL, press and hold for 5 meter pulses.
10. Switch to RUN.
11. When copy starts (indicated by change in meter pulses) press RECORD button.
12. At termination of copy, operate PAPER LOAD lever as in steps 5 and 6 to remove copy and reload.

7. TEST PROCEDURES.

The meter on the front panel, together with the CIRCUIT TEST switch and the PRESS TO TEST button, provide means for checking the principal circuits of the recorder.

Refer to Section 7, paragraph 4*b,* for test procedures and interpretation of test readings.

SECTION 5
OPERATOR'S MAINTENANCE

1. INTRODUCTION.

To maintain peak performance of the facsimile recorder, it is necessary that the operator perform a routine check when coming on watch and during each period that he is responsible for the operation of the equipment.

Minor defects may develop during operation which may be rectified without difficulty by the operator. The operator should be sufficiently familiar with the details of the facsimile recorder and associated equipment to service minor defects that may develop when technical aid is not available.

2. ROUTINE CHECK CHART.

Routine items to check are listed in Table 5–1.

TABLE 5–1. ROUTINE CHECK CHART

WHAT TO CHECK	HOW TO CHECK	PRECAUTIONS
Information from previous operator.	Review history in log book. Receive verbal instructions.	Note any changes in operation schedule.
Recording paper supply.	See that ample supply of paper is available.	A sheet of recording paper is required for each reception.
Stylus needle.	Open stylus guard door and examine needle.	If needle length is less than 1/32 in. replace with a new needle.
Operation of the equipment.	Turn on equipment and check operation of recorder as outlined in Section 4.	
Operation of auxiliary equipment.	Follow instructions for auxiliary equipment, from instruction books for equipment involved.	Note any signs of improper operation.

3. EMERGENCY MAINTENANCE.

a. NOTICE TO OPERATORS. — Secure proper authorization before attempting emergency maintenance.

Notice to Operators

Operators shall not perform any of the following emergency maintenance procedures without proper authorization.

b. REPLACEMENT OF FUSES.—All fuses of the facsimile Recorder RD–92A/UX are located on the front panel and are readily available to the operator. See Table 5–2 for symptoms of fuse failure.

WARNING

Never replace a fuse with one of higher rating, unless continued operation of the equipment is more important than the probable damage. If a fuse burns out immediately after replacement, do not replace it a second time until the cause has been corrected.

TABLE 5–2. SYMPTOMS OF FUSE FAILURE

SYMPTOM	FUSE
Characteristic tone of synchronous motor not heard and neon indicator above 1/8 AMP fuse on front panel lights.	F1 (1/8 AMP B+)
Pilot lamp on front panel does not light.	F2 and/or F3 (2 AMP. POWER)

c. REPLACEMENT OF TUBES.—Check correct locations of tubes before handling, and use care in handling.

WARNING

Turn off equipment and allow tubes to cool before handling. If immediate replacement is required, use a piece of cloth or an asbestos glove.

(1) LOCATION OF TUBES.—Before replacing an electronic tube, note the location from figure 5–1.

(2) REPLACING TUBES.

(*a*) Remove the tube retainer, as shown in figure 5–2.

(*b*) Use a gentle rocking motion when removing tubes.

TABLE 5-3. FUSE LOCATION

SYMBOL	LOCATION	PROTECTS	AMPS	VOLTS	NUMBER
F1	Front panel—to the right of pilot lamp.	High voltage circuits.	1/8	250	28032-1-8
F2	Front panel—between DENSITY and CIRCUIT TEST controls.	Input power circuit of recorder.	2	250	28061-2
F3	Front panel—between DENSITY and CIRCUIT TEST controls.	Input power circuit of recorder.	2	250	28061-2

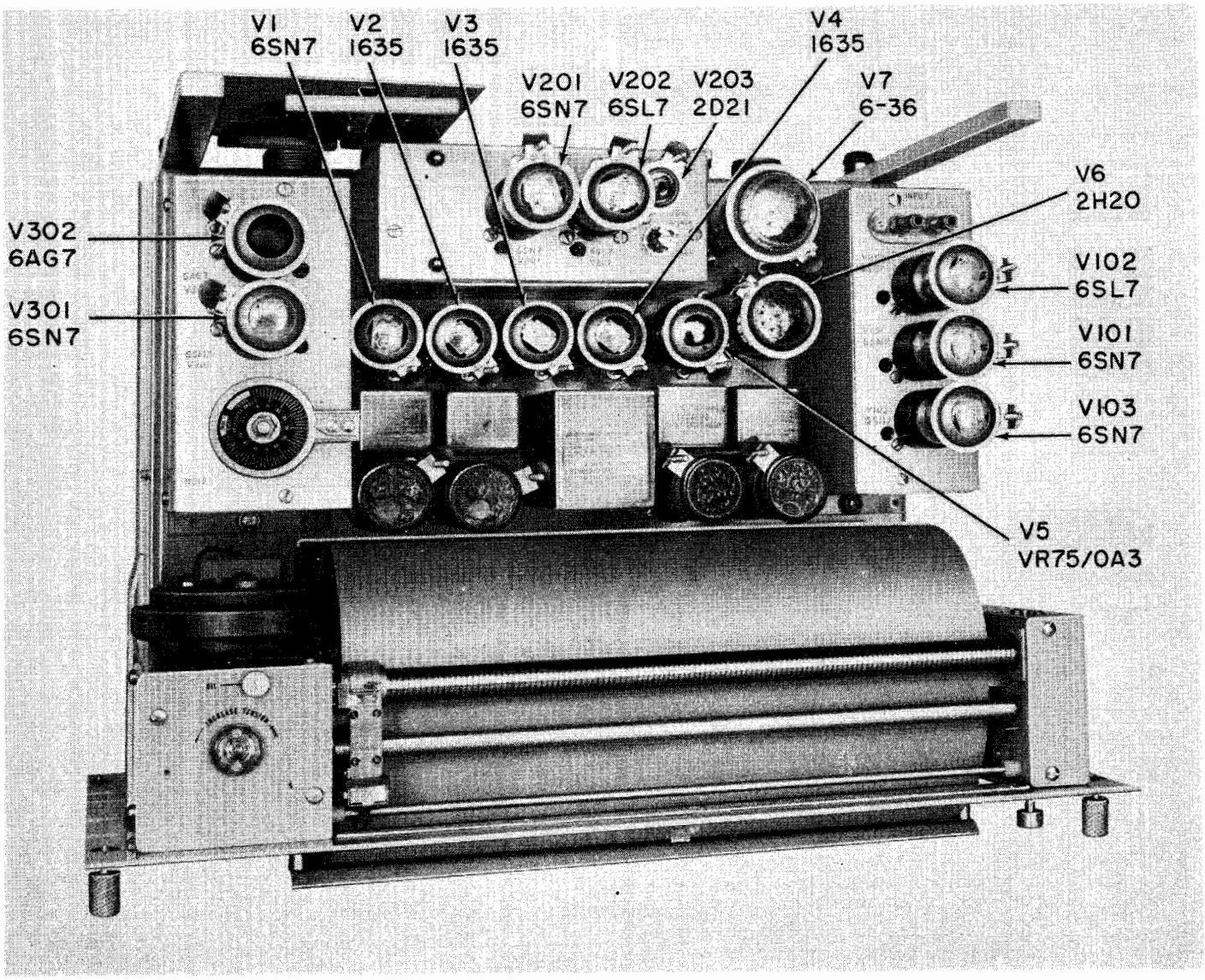


Figure 5-1. Tube Location

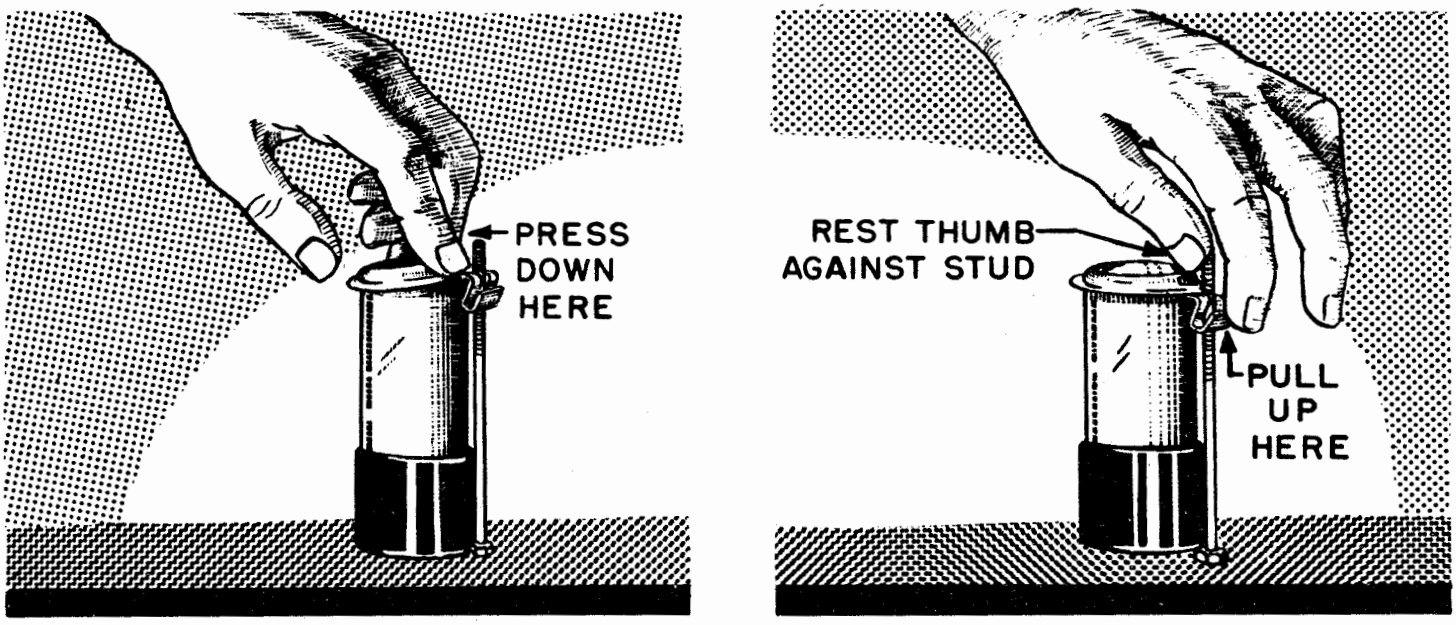


Figure 5–2. Removing Tube Retainer

(*c*) When inserting the replacement tube, align the tube pins with the socket, use a steady pressure, and push straight downward until the tube is seated properly.

(*d*) Replace the tube retainer.

(3) TUBES REQUIRING SPECIAL CARE.—Removal of V102, V202, and V302 requires a degree of caution and care.

(*a*) REPLACING V102 and V202. — When heater failure occurs in either V102 or V202, the recorder must be turned off and both tubes replaced.

WARNING

Do not remove either of these tubes while the power is on. Removal of either one of these tubes while the power is on will cause a heater failure in the other tube.

(*b*) REPLACING V302. — When replacing V302, this procedure must be followed:

1. Turn off the recorder and disconnect power source from equipment.
2. Remove the tube retainer.
3. Remove the bakelite cover of the tube.
4. Remove the tube.
5. After replacing the tube, put on the tube cover, and then clamp the tube with its retainer.

SECTION 6

PREVENTIVE MAINTENANCE

1. PREVENTIVE MAINTENANCE.

For the purpose of preventing failure or impairment of the equipment, the maintenance procedures and adjustments specified in this section are to be performed periodically as indicated in the Routine Maintenance Check Chart, Table 6–1.

NOTE

THE ATTENTION OF MAINTENANCE PERSONNEL IS INVITED TO THE REQUIREMENTS OF THE MOST RECENT ISSUE OF CHAPTER 67 OF THE *BUREAU OF SHIPS MANUAL.*

2. ROUTINE MAINTENANCE PROCEDURES.

The following routine maintenance procedures are followed in carrying out the checks specified in Table 6–1.

a. CHANGING THE STYLUS NEEDLE. — The stylus needle should be changed when the recording stylus wears down and the tungsten tip is less than $\frac{1}{32}$ inch long, or when the recording gets spotty and does not register properly part of the way around the drum.

(1) Turn the selector switch to OFF.

(2) Lift up the stylus guard door in front of the stylus needle.

(3) Remove the old stylus needle by pulling it straight out.

(4) Insert the new stylus needle by pushing it into the hole in the stylus mount until the shank seats itself.

On most stylus needles, it is possible to get longer life by removing the stylus needle from the mount and pulling on the tungsten wire until a longer piece extends beyond the brass holder. Care is necessary to prevent splitting the stylus needle. Because of the danger of splitting the stylus needle, stretching the tungsten wire is not recommended as a general practice.

b. CLEANING THE RECORDER. — The stylus guard door in front of the stylus needle, the dust pan beneath the drum, and the drum itself, should be cleaned periodically.

(1) Lift up the stylus guard door and wipe it with a dry cloth.

(2) Pull out the dust pan beneath the drum and shake out any carbon deposits.

(3) Inspect the drum and wipe off any carbon deposits. Use a damp cloth.

c. ELECTRICAL CIRCUITS.—To be sure that electrical circuits continue to function properly, check meter readings in all positions of the CIRCUIT TEST switch at not less than two week intervals. The test conditions, typical readings and remedies for improper readings are given in Section 7.

d. RECORDER SUBASSEMBLY. — The recording mechanism needs a routine check every two to four weeks, depending on the amount of use. It is best to remove the recorder subassembly from the amplifier-power supply chassis to adequately service the recording mechanism.

(1) Check to be sure that the two shipping chock screws have been removed from the rear of the recorder.

(2) Loosen the four knurled screws from the front panel and pull the set forward about 8 inches.

(3) Pull out the dust pan from underneath the drum and shake out any accumulation of carbon dust.

(4) Remove the four hexagonal head $10\frac{}{32}$ screws which hold the recorder subassembly to the amplifier-power supply chassis.

(5) Lift the recorder subassembly straight up and remove it from the amplifier-power supply chassis.

(6) Remove the housing at the rear and bottom of the drum and clean out any accumulated carbon dust. Replace housing.

(7) Every two months lubricate the recording mechanism by placing ten drops of light machine oil, in the oil hole at the top left end of the recorder subassembly. *(See figure 6–1.)*

It is not necessary to oil the gears of the left-hand gear box individually.

(8) Put one drop of oil on the cam rod.

(9) Remove the six screws holding the right-side cover of the right-hand gear box. Put one drop of oil on each gear and on each gear shaft once every 2 months. *(See figure 6–2.)*

(10) Use a clean dry cloth to clean the leadscrew shaft of all foreign matter. Do not use cleaning material containing lint or loose fibers. Use a knit material which reaches down into the threads of the shaft when looped underneath the leadscrew shaft and pulled tightly.

TABLE 6–1. ROUTINE MAINTENANCE CHECK CHART

PERIOD	WHAT TO CHECK	HOW TO CHECK	PRECAUTIONS AND REMEDIES
Daily	1. Stylus.	Open the stylus guard door and examine the stylus needle.	If needle is less than 1/32 in. long, replace. See par. 2*a*.
Weekly	1. Drum.	Inspect drum. See that it rotates freely and is clean.	Clean drum with a damp cloth, if necessary.
	2. Stylus guard door.	Inspect the guard door and see that it is free of dust and dirt.	Clean door with a damp cloth, if necessary.
	3. Dust pan.	Inspect for deposits of dust and dirt in pan.	Remove pan and clean out dust and dirt. See par. 2*b*.
	4. Meter readings.	Record in appropriate chart meter readings for each position of CIRCUIT TEST switch, when PRESS TO TEST switch is operated.	Improper readings indicate trouble. Refer to Section 7, Corrective Maintenance.
Monthly	1. Leadscrew shaft.	Inspect for deposits of carbon particles on shaft.	Brush out carbon particles with a nylon toothbrush.
	2. Carriage return spring.	Slide equipment out of cabinet to its stops. Move the stylus carriage to the right as far as it will go and release it. Note how it returns to its normal position.	If the carriage does not return smoothly and quickly, check for dirt that may cause faulty operation. Increase spring tension, if necessary.
	3. Motors.	Turn on equipment and listen for any unusual motor noises.	Refer to Section 7, Corrective Maintenance.
	4. Switches.	Inspect switches visually and operate them to see that they function properly.	Clean and repair when necessary.
	5. Transformers, chokes, capacitors, resistors, etc.	Visually and manually inspect all parts of the equipment for overheating and damage.	Replace or repair any part showing signs of breakdown, overheating, or damage.
	6. Half nut.	Remove half nut and inspect for carbon deposits in thread.	Clean half nut with nylon toothbrush.
	7. Nylon string.	Slide equipment from cabinet to its stops. Move stylus carriage to right and inspect for carbon dust on string.	Clean string with a damp cloth.
	8. Paper guide blade.	Open stylus guard door and examine the position of the paper guide blade.	Reposition the blade, if necessary.
	9. Recorder subassembly.	Operate the recorder and note any looseness or binding of gears.	Apply lubricant when necessary. See Lubrication Chart.
Quarterly	Tubes.	Check tubes with a suitable tube tester.	Replace tubes as necessary.
Semiannually	Recorder overhaul.	Disassemble and check every component possible. Replace parts where necessary.	An experienced technician should be present for reassembly.

(11) Loop the cloth underneath the leadscrew shaft and pull it back and forth to remove the dirt. Use a nylon bristle brush to clean out particles of dirt not removed by the cloth.

(12) Inspect carefully to be sure that no fibers from the cleaning cloth are left on the leadscrew shaft or the carriage subassembly, since this could cause the stylus carriage to jam.

(13) Wipe off any accumulation of carbon or dirt from the nylon string used to return the stylus carriage.

(14) Remove the four screws on top of the carriage subassembly and take off the plate which holds down the nylon half nut.

(15) Lift out the nylon half nut and clean with a nylon bristle toothbrush.

(16) Reassemble in the reverse order of disassembly.

3. LUBRICATION.

Lubrication data, showing the parts to be lubricated, the lubricant to use, and the frequency of lubrication, is given in figures 6–1 to 6–5. These show:

Figure 6–1. Lubrication of Sync Worm and Gear, and PAPER LOAD Lever.

Figure 6–2. Lubrication of Right-hand Gear Box.

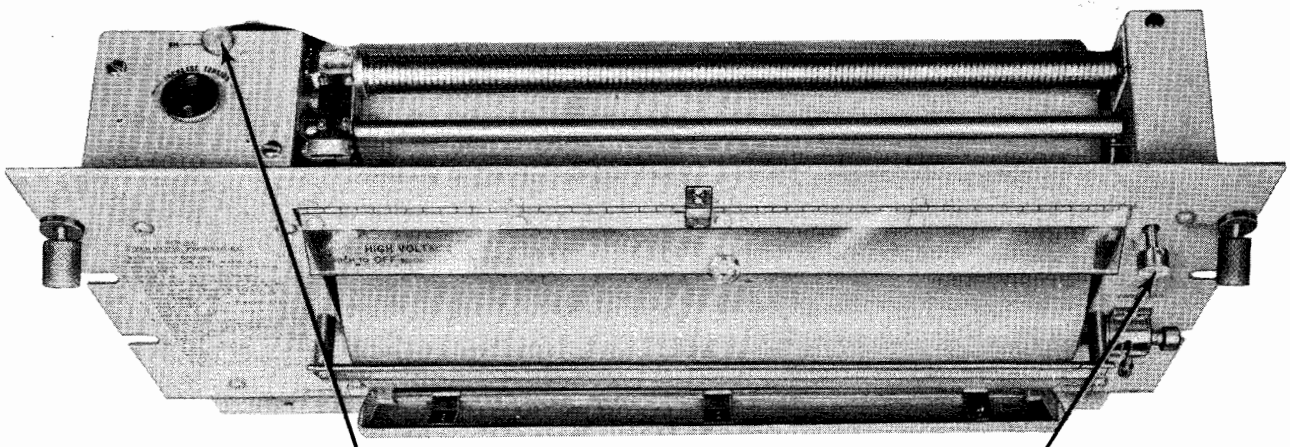
Figure 6–3. Lubrication of Latch Pivot.

Figure 6–4. Lubrication of Left-hand Gear Box.

Figure 6–5. Lubrication of Drive Subassembly.

4. RETROPICALIZATION.

No provision for tropicalization has been made at the factory and, in general, no retropicalization is required.



LEGEND
BW- BIWEEKLY
W- WEEKLY

SPECIFICATION NUMBER AND TITLE	TYPE	GRADE	CLASS	MILITARY SYMBOL	STANDARD NAVY STOCK NUMBER				
					4 Oz.	1 Qt.	5 Gal.	1 Lb.	5 Lb.
MIL-L-3503* Lubricating oil, preservative, light	.....	.....	.....	.....	W14-0-2831-800	W14-0-2831-810	W14-0-2833-65	.....	.....
14 L 3 Lubricant, ball- and roller bearing	.....	1	.....	.....	.....	.....	.....	W14-L-84-900	W14-L-84-910

*Formerly 14–L–7 (ORD) and O. S. 1362.

Figure 6–1. Lubrication of Sync Worm and Gear, and PAPER LOAD Lever

(11) Loop the cloth underneath the leadscrew shaft and pull it back and forth to remove the dirt. Use a nylon bristle brush to clean out particles of dirt not removed by the cloth.

(12) Inspect carefully to be sure that no fibers from the cleaning cloth are left on the leadscrew shaft or the carriage subassembly, since this could cause the stylus carriage to jam.

(13) Wipe off any accumulation of carbon or dirt from the nylon string used to return the stylus carriage.

(14) Remove the four screws on top of the carriage subassembly and take off the plate which holds down the nylon half nut.

(15) Lift out the nylon half nut and clean with a nylon bristle toothbrush.

(16) Reassemble in the reverse order of disassembly.

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Figure 6–5. Lubrication of Drive Subassembly.

4. RETROPICALIZATION.

No provision for tropicalization has been made at the factory and, in general, no retropicalization is required.

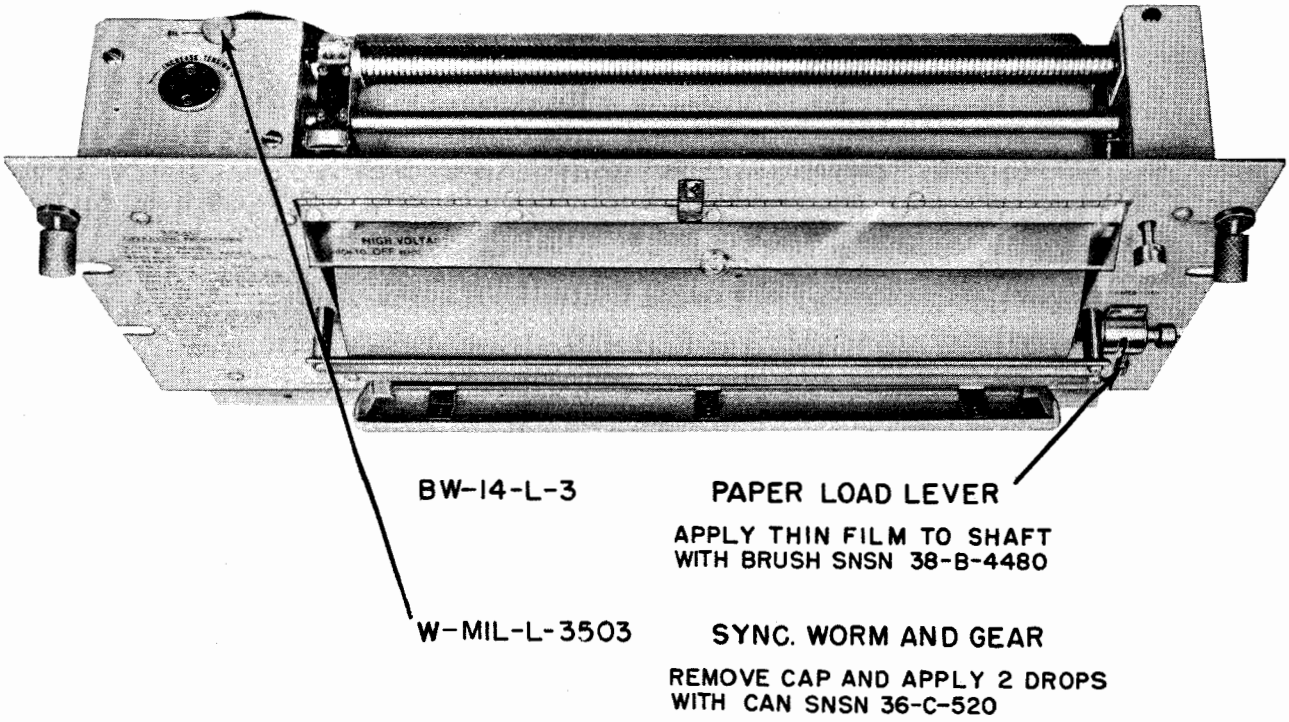
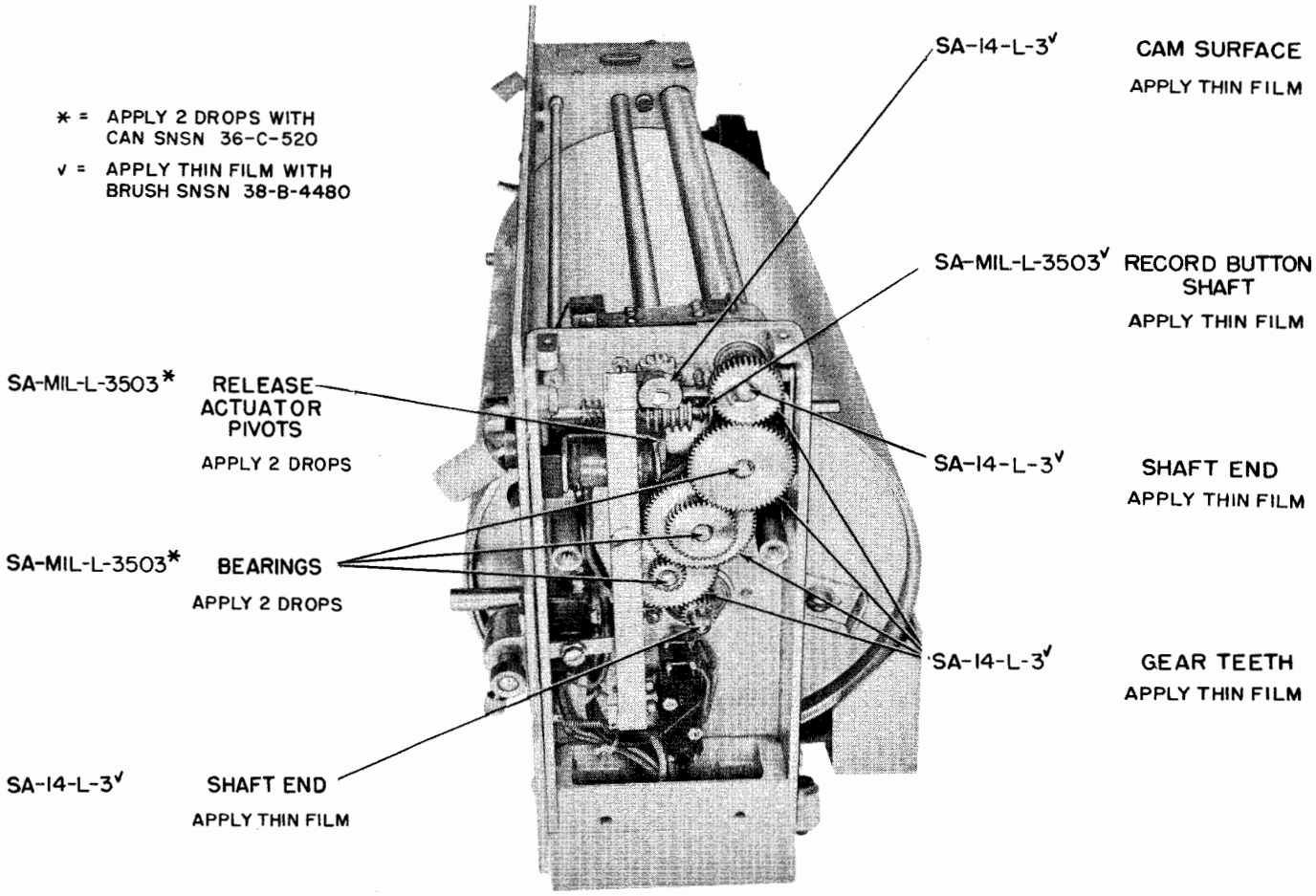


Figure 6–1. Lubrication of Sync Worm and Gear, and PAPER LOAD Lever

SPECIFICATION NUMBER AND TITLE	TYPE	GRADE	CLASS	MILITARY SYMBOL	STANDARD NAVY STOCK NUMBER				
					4 Oz.	1 Qt.	5 Gal.	1 Lb.	5 Lb.
MIL-L-3503* Lubricating oil, preservative, light	.....	.....	.....	.....	W14-0-2831-800	W14-0-2831-810	W14-0-2833-65	.....	.....
14 L 3 Lubricant, ball- and roller bearing	.....	1	.....	.....	.....	.....	.....	W14-L-84-900	W14-L-84-910

*Formerly 14–L–7 (ORD) and O. S. 1362.



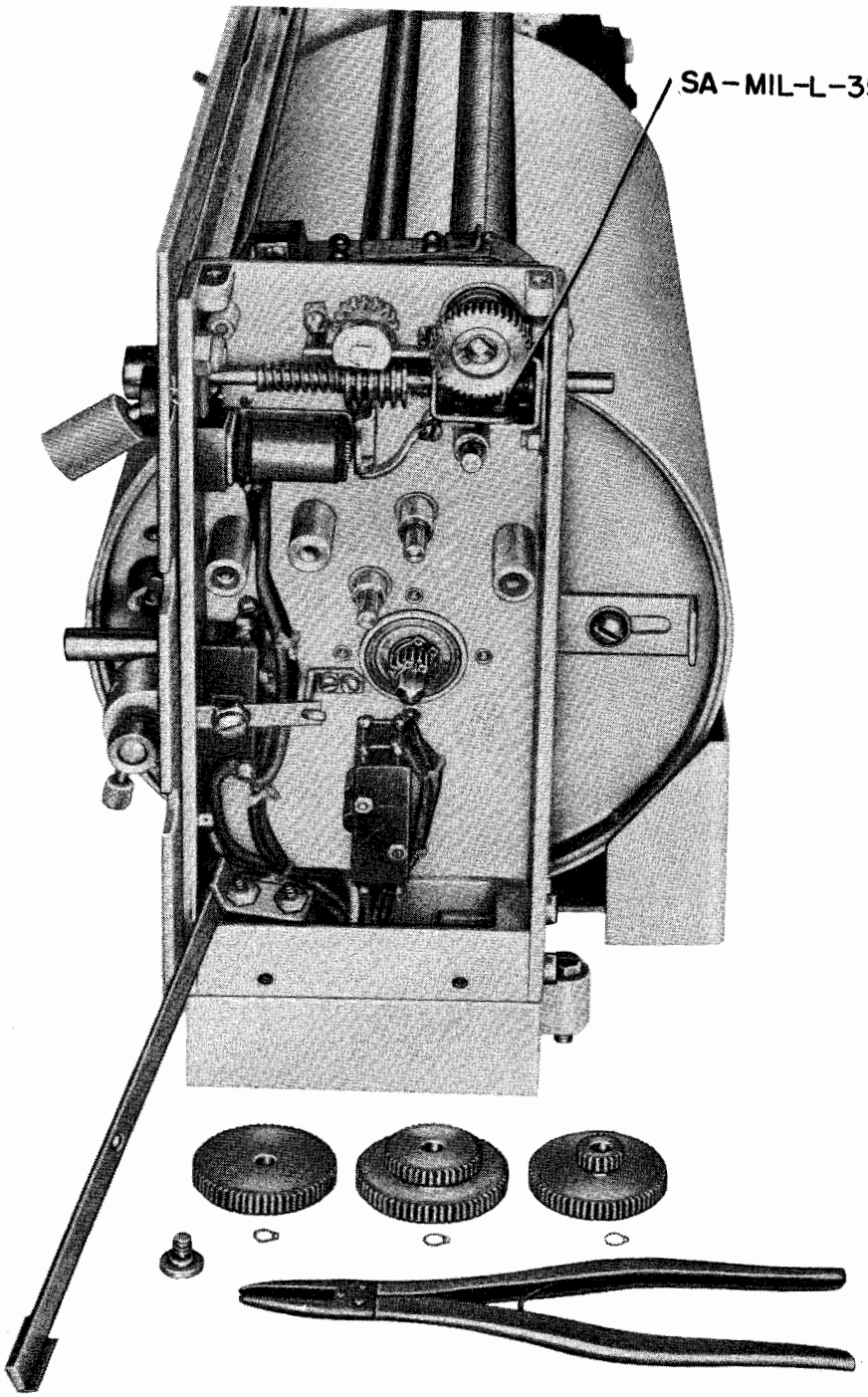
LEGEND

SA–SEMIANNUALLY

SPECIFICATION NUMBER AND TITLE	TYPE	GRADE	CLASS	MILITARY SYMBOL	STANDARD NAVY STOCK NUMBER				
					4 Oz.	1 Qt.	5 Gal.	1 Lb.	5 Lb.
MIL-L-3503* Lubricating oil, preservative, light	.....	.....	.....	.....	W14-0-2831-800	W14-0-2831-810	W14-0-2833-65	.....	.....
14 L 3 Lubricant, ball- and roller bearing	.....	1	.....	.....	.....	.....	.....	W14-L-84-900	W14-L-84-910

*Formerly 14–L–7 (ORD) and O. S. 1362.

Figure 6–2. Lubrication of Right-Hand Gear Box

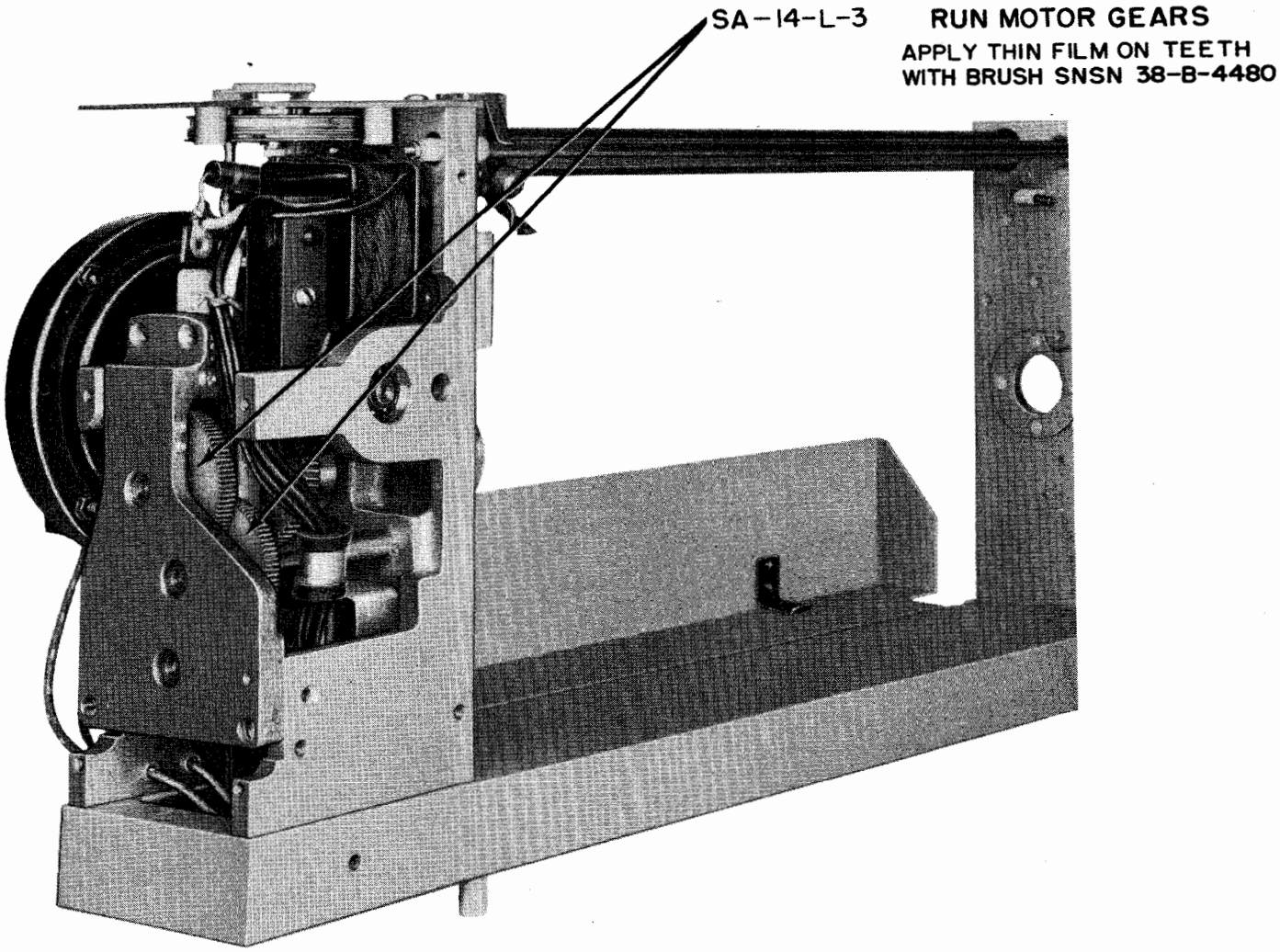


LEGEND
SA-SEMIANNUALLY

SPECIFICATION NUMBER AND TITLE	TYPE	GRADE	CLASS	MILITARY SYMBOL	STANDARD NAVY STOCK NUMBER				
					4 Oz.	1 Qt.	5 Gal.	1 Lb.	5 Lb.
MIL-L-3503* Lubricating oil, preservative, light	.....	.....	.....	.....	W14-0-2831-800	W14-0-2831-810	W14-0-2833-65	.....	.....

*Formerly 14-L-7 (ORD) and O. S. 1362.

Figure 6-3. Lubrication of Latch Pivot

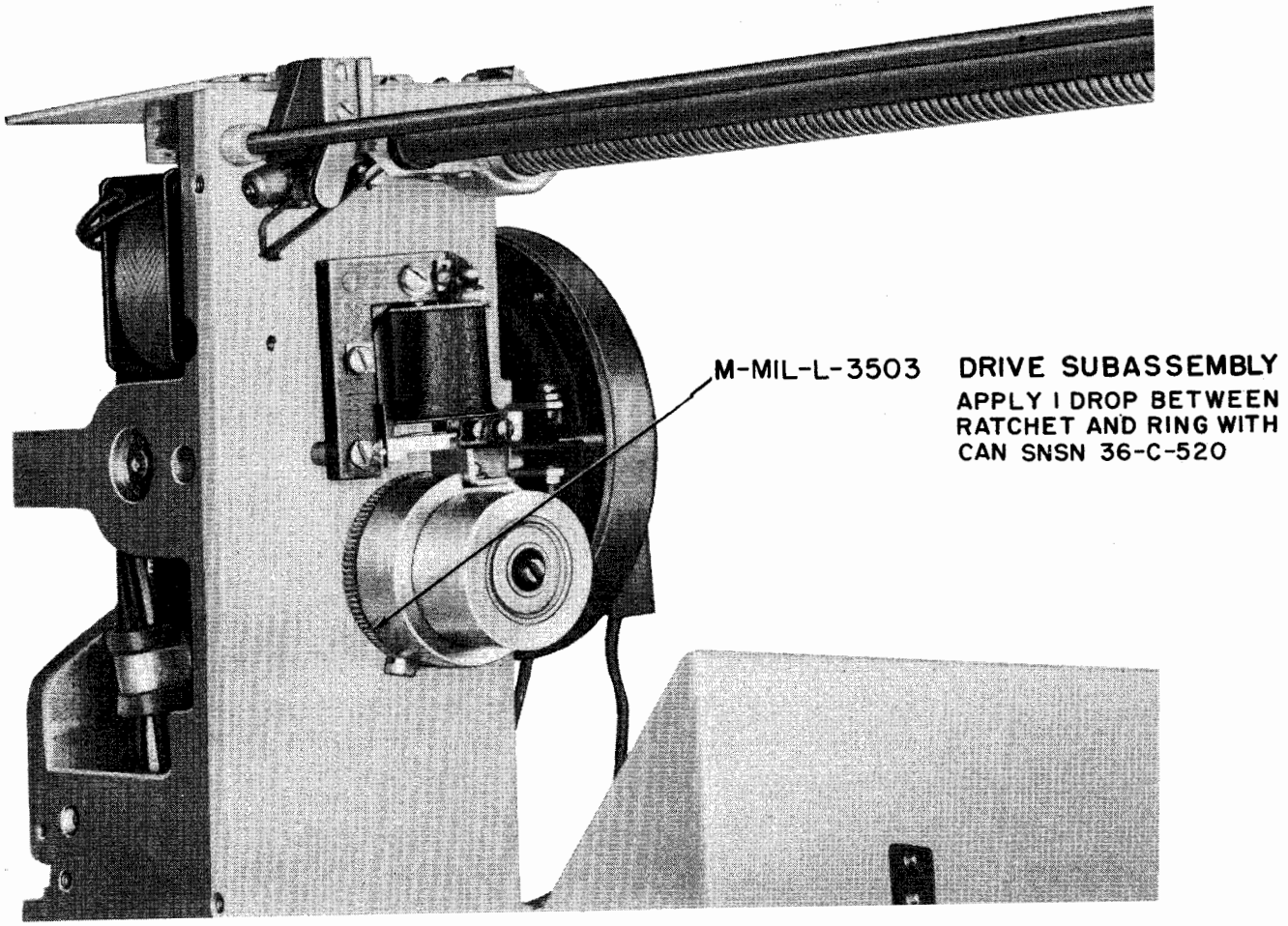


LEGEND

SA–SEMIANNUALLY

SPECIFICATION NUMBER AND TITLE	TYPE	GRADE	CLASS	MILITARY SYMBOL	STANDARD NAVY STOCK NUMBER				
					4 Oz.	1 Qt.	5 Gal.	1 Lb.	5 Lb.
14 L 3 Lubricant, ball- and roller bearing	.....	1	.....	.....	.....	.....	.....	W14-L-84-900	W14-L-84-910

Figure 6–4. Lubrication of Left-Hand Gear Box



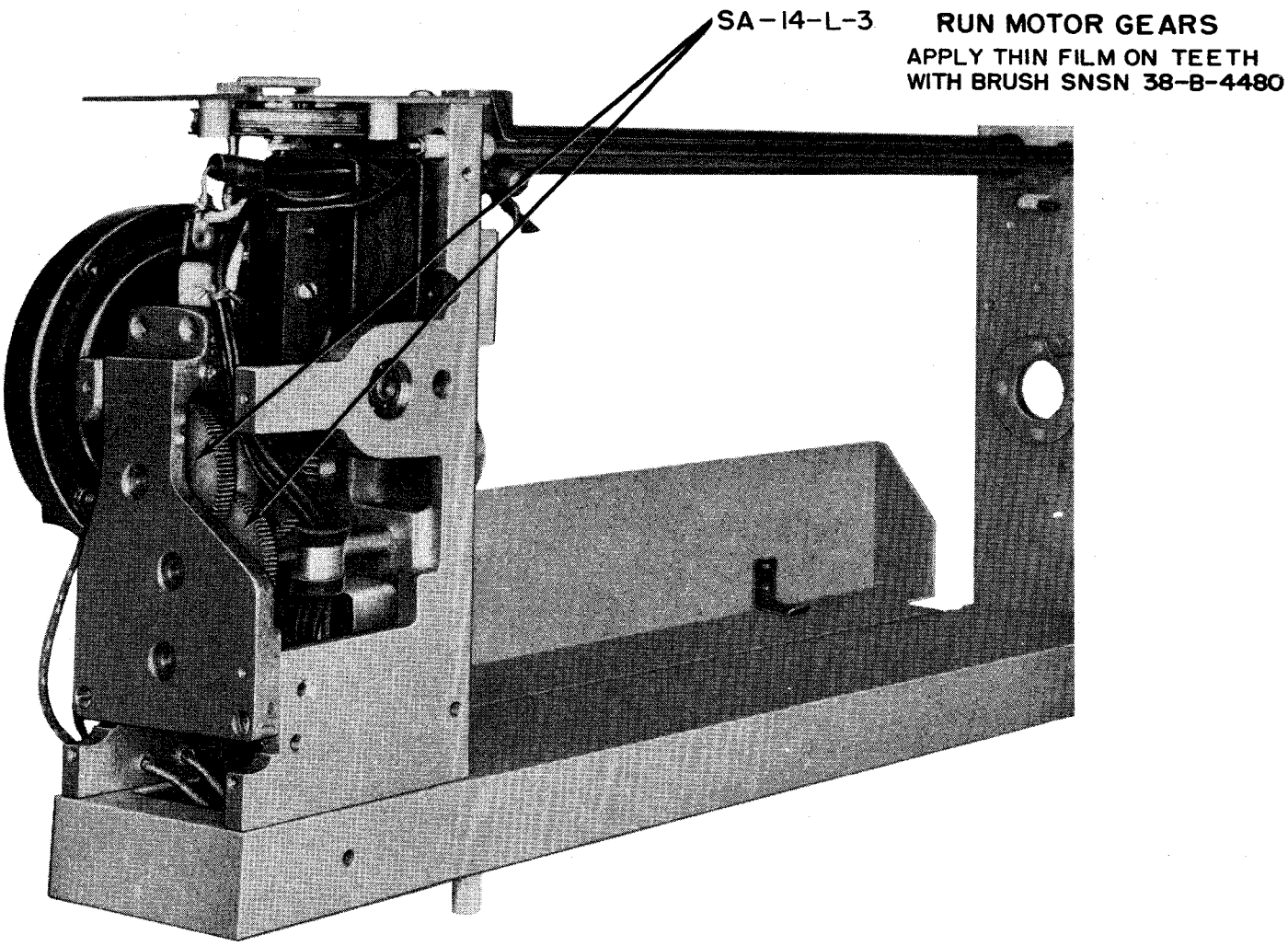
LEGEND

M–MONTHLY

SPECIFICATION NUMBER AND TITLE	TYPE	GRADE	CLASS	MILITARY SYMBOL	STANDARD NAVY STOCK NUMBER				
					4 Oz.	1 Qt.	5 Gal.	1 Lb.	5 Lb.
MIL-L-3503* Lubricating oil, preservative, light	.....	.....	.....	.....	W14-0-2831-800	W14-0-2831-810	W14-0-2833-65	.....	.....

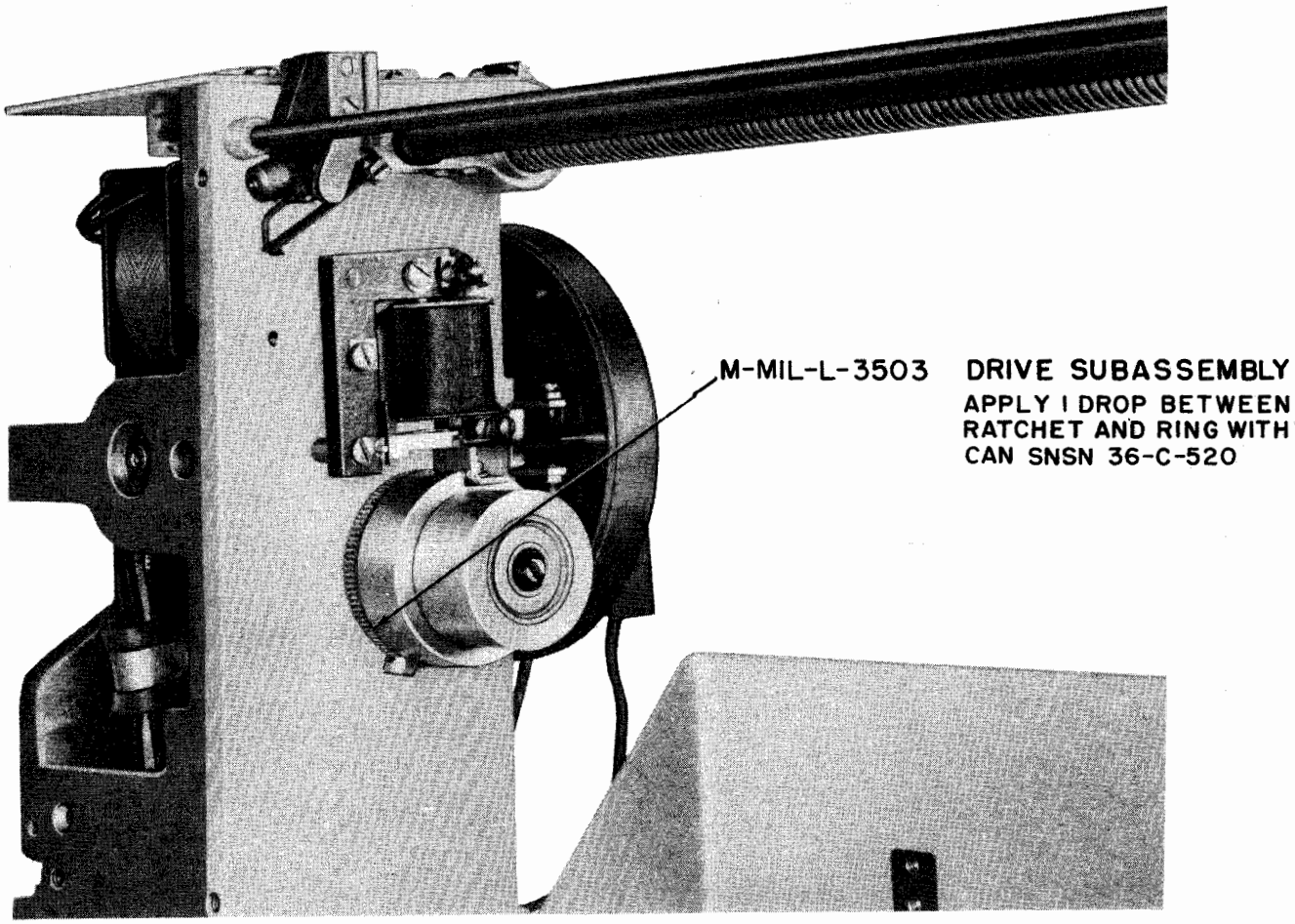
*Formerly 14–L–7 (ORD) and O. S. 1362.

Figure 6–5. Lubrication of Drive Subassembly



SPECIFICATION NUMBER AND TITLE	TYPE	GRADE	CLASS	MILITARY SYMBOL	STANDARD NAVY STOCK NUMBER				
					4 Oz.	1 Qt.	5 Gal.	1 Lb.	5 Lb.
14 L 3 Lubricant, ball- and roller bearing	.....	1	.....	.....	.....	.....	.....	W14-L-84-900	W14-L-84-910

Figure 6–4. Lubrication of Left-Hand Gear Box



SPECIFICATION NUMBER AND TITLE	TYPE	GRADE	CLASS	MILITARY SYMBOL	STANDARD NAVY STOCK NUMBER				
					4 Oz.	1 Qt.	5 Gal.	1 Lb.	5 Lb.
MIL-L-3503* Lubricating oil, preservative, light	.....	.....	.....	.....	W14-0-2831-800	W14-0-2831-810	W14-0-2833-65	.....	.....

*Formerly 14–L–7 (ORD) and O. S. 1362.

Figure 6–5. Lubrication of Drive Subassembly

SECTION 7
CORRECTIVE MAINTENANCE

1. CORRECTIVE MAINTENANCE.

This section contains all information necessary to a technician for locating trouble and for making repairs and adjustments to the Facsimile Recorder RD–92A/UX. The calibration and the operation of the built-in test circuit are also fully explained.

2. FAILURE REPORT.

In the event of equipment failure, a failure report must be filled out in accordance with the requirements given below. Keep a careful record of performance and of all failures, corrections, adjustments, and repairs both for reference purposes and as a standard for comparison.

3. THEORY OF LOCALIZATION.

Facsimile Recorder RD–92A/UX is so designed that most operating troubles may be isolated to a particular circuit by operating the CIRCUIT TEST switch on the front panel and reading the associated meter. Operation of this built-in test circuit is fully described in paragraph 7–5*c*(3). As a further aid in localizing trouble, neon indicators are connected across tube heaters and fuses. These indicators are mounted near the socket in the case of tubes and on the front panel in the case of fuses. A lighted neon bulb indicates that its associated component is open. Wiring and operation of these indicators is further discussed in paragraph 7–*4a.*

To facilitate trouble shooting and servicing, the recorder is composed of four subassemblies plugged in to the amplifier-power supply, which serves as the basic chassis. When a second set that is known to operate properly is available, trouble may be quickly located by substituting in turn the plug-in subassemblies.

When trouble shooting, keep in mind that not all faulty operation is due to defects in the equipment. The operator may have failed to perform one of the required functions at the proper time, or there may be interference, such as intermittent or spurious signals, in the transmission circuit.

FAILURE REPORTS

A FAILURE REPORT must be filled out for the failure of any part of the equipment whether caused by defective or worn parts, improper operation, or external influences. It should be made on Failure Report, form NBS-383, which has been designed to simplify this requirement. The card must be filled out and forwarded to BUSHIPS in the franked envelope which is provided. Full instructions are to be found on each card.

Use great care in filling the card out to make certain it carries adequate information. For example, under "Circuit Symbol" use the proper circuit identification taken from the schematic drawings, such as T–803, in the case of a transformer, or R–207, for a resistor. Do not substitute brevity for clarity. Use the back of the card to completely describe the cause of failure and attach an extra piece of paper if necessary.

The purpose of this report is to inform BUSHIPS of the cause and rate of failures. The information is used by the Bureau in the design of future equipment and in the maintenance of adequate supplies to keep the present equipment going. The cards you send in, together with those from hundreds of other ships, furnish a store of information permitting the Bureau to keep in touch with the performance of the equipment of your ship and all other ships of the Navy.

This report is not a requisition. You must request the replacement of parts through your Officer-in-Charge in the usual manner.

Make certain you have a supply of Failure Report cards and envelopes on board. They may be obtained from the nearest district printing and publications office.

4. SYSTEM TROUBLE SHOOTING.

a. NEON INDICATORS.—Since a burned-out tube or fuse is a common source of trouble in electronic equipment, a means for quickly locating the faulty tube or fuse can save operating time. In the Facsimile Recorder RD–92A/UX, neon indicators are connected across each tube heater and across the high B+ fuse.

Since the heaters of the tubes are connected in series, normally the voltage drop across each tube is quite small, much too small to operate a neon light. However, when an element in the series circuit, such as a fuse or tube heater, burns out, an open circuit develops, current ceases to flow through the series circuit, and the open circuit voltage appears across the neon indicator paralleling the element that has burned out. The neon tube, its current limited by a series resistor, lights, indicating the defective tube or fuse.

Before replacing the burned-out tube or fuse, be sure to determine and correct the cause of the failure. Refer to the trouble shooting chart, Table 7–1.

It may happen that two or more elements in a series circuit may burn out at the same time, although this condition is unlikely since as soon as the first element burns out, the circuit opens and the load is removed from the other parts. When two burn-outs occur simultaneously, the neon indicators across the defective parts will not light. It is then necessary to test for the open heaters or fuses with an ohmmeter or other continuity checker.

b. LOCATING TROUBLE FROM FRONT PANEL CHECKS.—General experience shows that trouble symptoms reported by the operator are not necessarily accurate. When trouble is reported check the operation of the recorder by taking meter readings for each position of the CIRCUIT TEST switch, under the conditions outlined below. After all the readings have been taken and recorded, refer to the trouble shooting chart, Table 7–1, for the possible cause of trouble.

Refer to simplified schematic, figure 7–1 and over-all schematic, figure 7–13. The CIRCUIT TEST switch, S4, with the meter, M1, at the center of the control panel as indicator, enables a quick circuit check when trouble is encountered.

(1) NORMAL TEST CONDITIONS.—In order to obtain comparable readings, the setting of the recorder controls must be standardized. Unless otherwise specified, standard conditions for all tests are: synchronous motor running in SYNC position and DENSITY control switched to TEST SIGNAL position. The test is then made by rotating the switch pointer to the position indicating the circuit to be tested and depressing the PRESS TO TEST switch. The normal meter reading for all positions except PHASE AMP OUT and PRINT is approximately 100.

This uniform test reading for all positions is obtained by including in each circuit a correcting resistor, marked *, which is selected to give the desired uniform meter reading under normal test conditions. The procedure for calibrating the test circuits and for determining the proper values of correcting resistors is given in paragraph 7–5*c*(3).

(2) CIRCUIT TEST POSITIONS. — There are eleven CIRCUIT TEST positions. Each test position is checked as follows:

(*a*) POWER.—This position measures the line voltage at the recorder, ahead of the power switch. A reading of 100 on the meter indicates a normal voltage of 117 volts on the power line.

(*b*) SIG AMP OUT.—To obtain the proper reading, adjust the DENSITY control to lowest position that will give maximum reading on the meter if a facsimile signal is being received or, if no signal is received, rotate the control to the TEST SIGNAL position. The meter reading indicates a value proportional to the amount of d-c signal available at the output of the signal amplifier unit for keying the modulator tube V202A. With no input or test signal the meter reading should be about 45.

(*c*) PHASE AMP OUT.—For proper reading adjust the DENSITY control as indicated in subparagraph (*b*) above. Phasing pulses must be received. With the PHASE and PRESS TO TEST switches both depressed and the phasing thyratron V203 functioning properly, the meter pointer pulses upward once each second as the phasing pulses are received.

(*d*) LO B+.—This position checks the B+ voltage for the signal amplifier. If the meter reads 100 in POWER position and does not read 100 in LO B+ position, selenium rectifier CR4 or capacitor C7 or C8 may be defective.

(*e*) HI B+.—This position checks the B+ voltage applied to the phase, synchronous-motor, and print amplifiers. The meter should read about 100 when the synchronous motor is running. If the meter reads 100 in the POWER position and does not register near 100 in HI B+ position, rectifiers CR1, CR2, or CR3 or capacitors C5, C6, or C8 may be defective.

(*f*) SYNC DRIVE.—This position checks the signal applied to the grids of the motor amplifier tubes V2 and V3. The meter reading may vary widely from 100, depending on the setting of the SYNC MA potentiometer at the back of the recorder. An exceptionally low reading may be caused by a defective tube V1, V301, or V302.

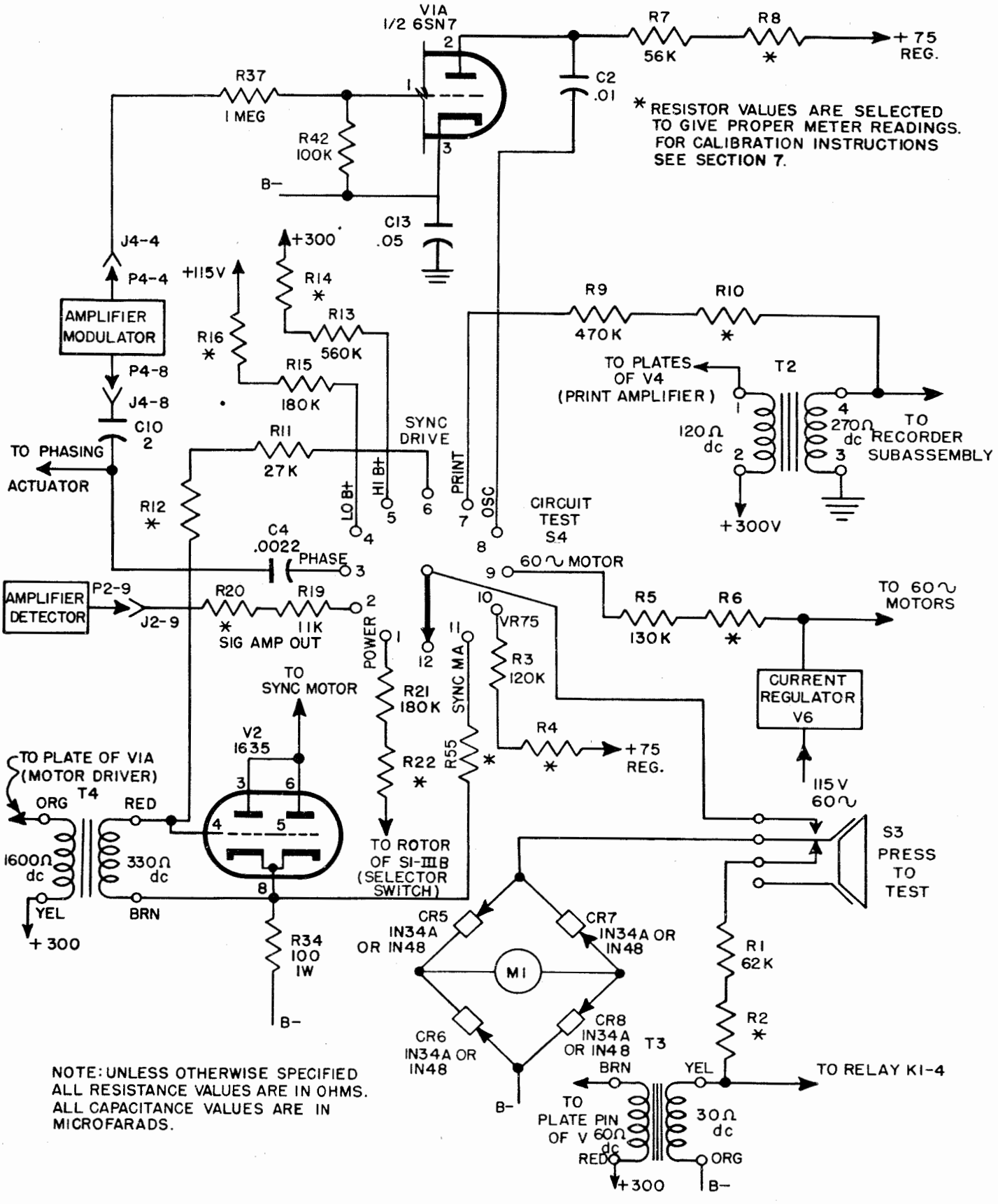


Figure 7–1. Simplified Schematic of CIRCUIT TEST Switch Circuits

(*g*) PRINT.—Adjust the DENSITY control as indicated in subparagraph (*b*) above, and engage the stylus so that copy is being printed on the recording paper. Under steady-state maximum signal, the meter should read about 100. If the reading is exceptionally low, the fault may be a defective tube V4, V201, or V202.

(*h*) OSC.—This position checks the voltage output of the 15 kc oscillator. If the meter reading is considerably less than 100, the fault may be a defective tube V201 or V1.

(*i*) 60 ~ MOTOR.—This position checks the voltage applied to the start or run motor. This voltage is regulated by tube V6 and a reading of nearly 100 should result in the SYNC or RUN position of the selector switch. If the reading is not near 100, tube V6 may be defective. In STANDBY or START position, since the motors are not drawing current, the reading should be high.

(*j*) VR75.—This position checks the voltage at the voltage regulator, VR75/OA3. If the meter does not read approximately 100, tube V5 or capacitors C7 or C8 may be defective.

(*k*) SYNC MA.—This position checks the direct current through the synchronous motor. The meter should read between 85 and 100 with the synchronous motor running, when the SYNC MA control at the rear of the recorder is properly adjusted. If a reading above 85 cannot be obtained, tube V2 or V5 may be defective.

c. TROUBLE SHOOTING CHART.—After observing the operation of the recorder and the meter indications for each position of the CIRCUIT TEST switch, refer to the trouble shooting chart Table 7–1 for the probable cause and means of correction.

TABLE 7–1. TROUBLE SHOOTING CHART

TROUBLE	PROBABLE CAUSE	CORRECTION
1. Drum does not rotate and Sync tone heard.		
a. No reading in 60~ MOTOR position.	*a.* V6 (2H20) burned out (neon light beside tube lit).	*a.* Replace V6.
b. Reading about 150 in 60~ MOTOR position selector switch in RUN.	*b.* Circuit is open to RUN motor. (1) PHASE button in REMOTE. (2) Poor contact in switch S2, selector switch S1 or relay K1.	*b.* (1) Turn to LOCAL. (2) Clean contacts and adjust if necessary.
c. Reading about 100 in 60~ MOTOR position.	*c.* (1) Dust pan or brush jammed against drum. (2) PAPER LOAD mechanism holding drum. (3) Gears in RH or LH gear box frozen to shaft or dirty. (4) Sync motor did not fall into synchronism. (5) If buzzing sound is heard, phasing actuator has not operated. (6) Drum key disengaged from drum shaft. (7) Paper load blade jammed against drum. (8) Pin outside gear hub on drum drive shaft broken (LH gear box). (9) Paper clamp fingers open and hit against dust pan.	*c.* (1) Reposition dustpan and brush. (2) Release PAPER LOAD mechanism. (3) Clean and oil gears. (4) See 6 under "Trouble" column. (5) See 7 under "Trouble" column. (6) Engage drum shaft and tighten locking screw. (7) Remove blade and straighten. (8) Replace gear. (9) Close clamping fingers.
2. Drum does not rotate and Sync tone not heard.		
a. No reading in POWER position.	*a.* A-C plug out or no a-c power.	*a.* Plug in a-c power.
b. CIRCUIT TEST readings in only LO B+, HI B+, 60 ~ MOTOR and VR75 positions.	*b.* Burned-out tube heater (any tube).	*b.* See 6b under TROUBLE column.
c. Same as b. except not all tubes light and V7 may be bright.	*c.* Tube heater to cathode short.	*c.* Replace last tube in heater string which is lit. If this does not work, replace the adjacent tube in string which is not lit.

TABLE 7–1. TROUBLE SHOOTING CHART (Continued)

TROUBLE	PROBABLE CAUSE	CORRECTION
3. Drum rotates slower than 60 rpm.		
a. Click heard occasionally.	*a.* (1) Brush loading drum too heavily.	*a.* (1) Adjust dust pan.
	(2) Gears in RH or LH gear box do not turn freely.	(2) Check gears.
b. Click not heard.	*b.* (1) Sync motor did not fall into synchronism.	*b.* See 5 and 6b under "Trouble" column.
4. Drum rotates faster than 60 rpm.		
a. Loud "bang" heard.	*a.* (1) Sync motor stopped or running below synchronous speed.	*a.* (1) See 5 and 6b under "Trouble" column.
	(2) Intermediate latch springs in coupling section too weak or one disengaged.	(2) Replace spring.
	(2) B+ fuse blown. Lamp above fuse lit.	(3) Turn off set and wait for lamp to go out before replacing fuse.
b. Loud "bang" not heard.	*b.* (1) Dog arm spring broken or dog arm stuck (coupling section).	*b.* (1) Replace spring and clean dog arm pivot.
	(2) Intermediate latch springs in coupling section broken or disengaged.	(2) Replace springs.
	(3) Clamp ring on sync gear in LH gear box loose.	(3) Tighten clamp ring screw.
	(4) Compo thrust bearing spring on RH gear box cover broken or defective allowing drum to shift to right.	(4) Replace spring.
	(5) Stop bar in the drive subassembly out of position.	(5) Reposition the stop bar and tighten screw.
5. Motor falls through sync speed when attempting to start.		
a. Low reading in SYNC MA position and other readings normal.	*a.* Motor current too low.	*a.* (1) Adjust SYNC MA pot for reading of 100.
		(2) Replace V2 and V3.
b. Same as 5a except SYNC DRIVE reading low.	*b.* (1) SYNC MA pot set too low.	*b.* (1) Adjust SYNC MA pot for reading of 100.
	(2) Defective V1, V301, V302 or V7.	(2) Replace defective tube.
c. SYNC MA reading about 100.	*c.* (1) Decoupling of sync motor stator too stiff or too weak.	*c.* (1) Check adjusting screw setting.
	(2) Start motor weak.	
	(3) Mechanical interference between motor and gear box.	
d. Same as 5b and 60 ~ MOTOR reads 0.	*d.* V6 burned out (neon beside tube lit).	*d.* Replace V6 (2H20).
6. *a.* SYNC motor drops out of sync in RUN position.	*a.* (1) Motor current too low.	*a.* (1) See 5a under "Trouble" column.
	(2) Decoupling of sync motor stator too stiff or too weak.	(2) Check adjusting screw setting.
	(3) Run motor too strong.	(3) Reduce rotor diameter in steps of 0.005 in. until satisfactory operation is obtained.
b. CIRCUIT TEST readings in only POWER, LO B+, HI B+, 60 ~ MOTOR, and VR75.	*b.* Burned-out tube heater (any tube).	*b.* In STAND BY position examine lamps beside each tube. Replace tubes or tubes adjacent to neons which were lit.

TABLE 7–1. TROUBLE SHOOTING CHART (Continued)

TROUBLE	PROBABLE CAUSE	CORRECTION
7. Does not phase properly.		
a. Meter pulses upward once a second in PHASE AMP OUT position when the PHASE button is depressed and phasing pulses are received.	*a.* (1) Phasing actuator armature sticks. (2) Holding current contact on relay K1 does not open.	*a.* (1) Remove actuator and clean. (2) Readjust contact.
b. Meter pulses as in 7a, but phases in wrong position.	*b.* Screw which clamps the coupling section on drum is loose.	*b.* Center position of coupling section and tighten screw.
c. Same as 7a, but phases on every other pulse.	*c.* Dog arm spring too strong or clutch pawl spring too weak.	*c.* Release PHASE button immediately after pulse which releases drive subassembly for emergency operation. Remedy fault by replacing defective coupling section or drive subassembly.
8. Stylus does not feed properly.	*a.* Poor engagement of half nut. *b.* Dirty lead screw or cam rod. *c.* Stylus carriage return spring jammed. *d.* Return spring cord hole in casting jammed with dirt.	*a.* Clean half nut and cam rod. *b.* Clean with soft cloth. *c.* Loosen and repair spring. *d.* Clean the hole.
9. Stylus carriage does not return.	*a.* Dirty leadscrew, cam rod, or bushing. *b.* Weak stylus carriage return spring. *c.* Switch S7 out of adjustment. *d.* Return spring cord hole in casting jammed with dirt.	*a.* Clean with soft cloth. *b.* Tighten spring. *c.* Reposition switch. *d.* Clean the hole.
10. Does not print.		
a. No meter reading DENSITY control is turned to TEST SIGNAL position and reading of about 50 in SIG AMP OUT position.	*a.* Defective 6SN7 tube V101 or 6SL7 tube V102.	*a.* Replace tubes.
b. Same as 10a except for reading of about 100 in SIG AMP OUT position and 100 in OSC position.	*b.* (1) Defective 6SL7 tube V202 or 6SN7 tube. (2) Defective crystal CR201.	*b.* (1) Replace tubes. (2) Remove crystal if no replacement is available.
c. Meter reading of about 100 when DENSITY control is turned to TEST SIGNAL position. Meter reading drops to about 50 when RECORD button is pressed and reading of about 100 in PRINT position.	*c.* (1) No signal being received. (2) DENSITY control set too low.	*c.* (1) Wait for facsimile transmission. (2) Set DENSITY control higher.
d. Same as 10c except for reading of about 15 in PRINT position.	*d.* (1) Stylus assembly or trolley rod shorted to ground (possibly inside top cover for LH gear box).	*d.* Locate short and take precautions so that it will not reoccur.
e. Same as 10c except for a reading of about 130 in PRINT position.	*e.* (1) Stylus needle worn too short so that it doesn't touch the drum. (2) Stylus assembly contact to trolley rod dirty, broken, or out of adjustment. (3) Wire to trolley rod broken.	*e.* (1) Replace stylus needle. (2) Clean and adjust contact. (3) Replace wire.
f. Same as 10c except for a reading of about 5 in PRINT position.	*f.* Stylus transformer T2 defective.	*f.* Replace T2.
g. Same as 10c except that meter reading does not drop when RECORD button is depressed.	*g.* Switch S6 in RH gear box out of adjustment or defective.	*g.* Replace or repair S6.
h. Same as 10b except meter reads nearly 0 in OSC position.	*h.* Defective V201 (6SN7).	*h.* Replace tube.

TABLE 7–1. TROUBLE SHOOTING CHART (Continued)

TROUBLE	PROBABLE CAUSE	CORRECTION
11. Poor quality of received copy.		
a. Lines too broad.	*a.* DENSITY control set too high.	*a.* Reduce DENSITY control.
b. Background prints.	*b.* (1) DENSITY control set too high. (2) Defective IN34A crystal, CR 201.	*b.* (1) Reduce DENSITY control. (2) Remove crystal if no replacement is available.
c. Copy fuzzy.	*c.* (1) Defective stylus needle. (2) Dirty stylus needle. (3) Radio receiver being overloaded.	*c.* (1) Replace stylus needle. (2) Clean stylus needle. (3) Reduce RF gain so that radio receiver output is undistorted and tune for maximum signal.
d. Blank spaces in copy.	*d.* (1) Stylus needle worn too short. (2) Drive subassembly shaft bent or drum is eccentric. (3) Trolley rod bent so that stylus assembly contact does not touch for a portion of recording.	*d.* (1) Replace stylus needle. (2) Replace faulty component. (3) Adjust stylus rod contact.
e. Light copy.	*e.* (1) Dirty trolley rod and stylus assembly. (2) DENSITY control set too low. (3) Weak 1635 tube (V4). (4) Dirty drum.	*e.* (1) Clean with a soft cloth. (2) Increase DENSITY control. (3) Replace V4. (4) Clean with damp cloth.
f. HI B+ reads about 20 lower than in POWER position.	*f.* Selenium rectifiers CR1, CR2, and CR3 are defective.	*f.* Replace rectifiers.
12. Hum prints in received copy (60 or 120 lines across length of sheet).	Defective 6SL7 tube. V102 or V202 (heater to cathode short).	Replace tube.
13. 2 AMP POWER fuses open.	Defective electrolytic capacitor C5, C6, C7, or C8.	Replace capacitor and fuses.
14. 1/8 AMP B+ fuse open (neon lights above fuse-holder).	*a.* Defective 2D21 tube V203. *b.* Defective electrolytic capacitor C6 and fuse. *c.* Sync motor current too high.	*a.* Replace tube and fuse. *b.* Replace capacitor and fuse. *c.* Readjust SYNC MA and replace fuse. Reduce reading to 100 in SYNC MA position with SYNC MA potentiometer, located on rear of chassis.

5. UNIT TROUBLE SHOOTING AND MECHANICAL REPAIR.

a. TROUBLE SHOOTING.

(1) TROUBLE SHOOTING CHART.—The CIRCUIT TEST switch with the meter on the front panel enables tests to be made on the Facsimile Recorder RD–92A/UX as a single unit. The readings obtained, when checked with the Trouble Shooting Chart, Table 7–1, give an indication of the particular section of the recorder and frequently the particular part that is at fault.

(2) CIRCUIT CONSTANTS.

(*a*) LOCATION OF CIRCUIT COMPONENTS.—Circuit components may be readily identified by reference to the following illustrations:

Figure 7–2. Location of Parts and Wiring Diagram: Amplifier-Detector Subassembly.

Figure 7–3. Location of Parts and Wiring Diagram: Amplifier-Modulator Subassembly.

Figure 7–4. Location of Parts and Wiring Diagram: Audio-Frequency Oscillator Subassembly.

Figure 7–5. Location of Parts and Wiring Diagram: Recorder Subassembly.

Figure 7–6. Bottom View of Amplifier—Power Supply Chassis.

Figure 7–14. Location of Parts and Wiring Diagram: Amplifier-Power Supply Chassis.

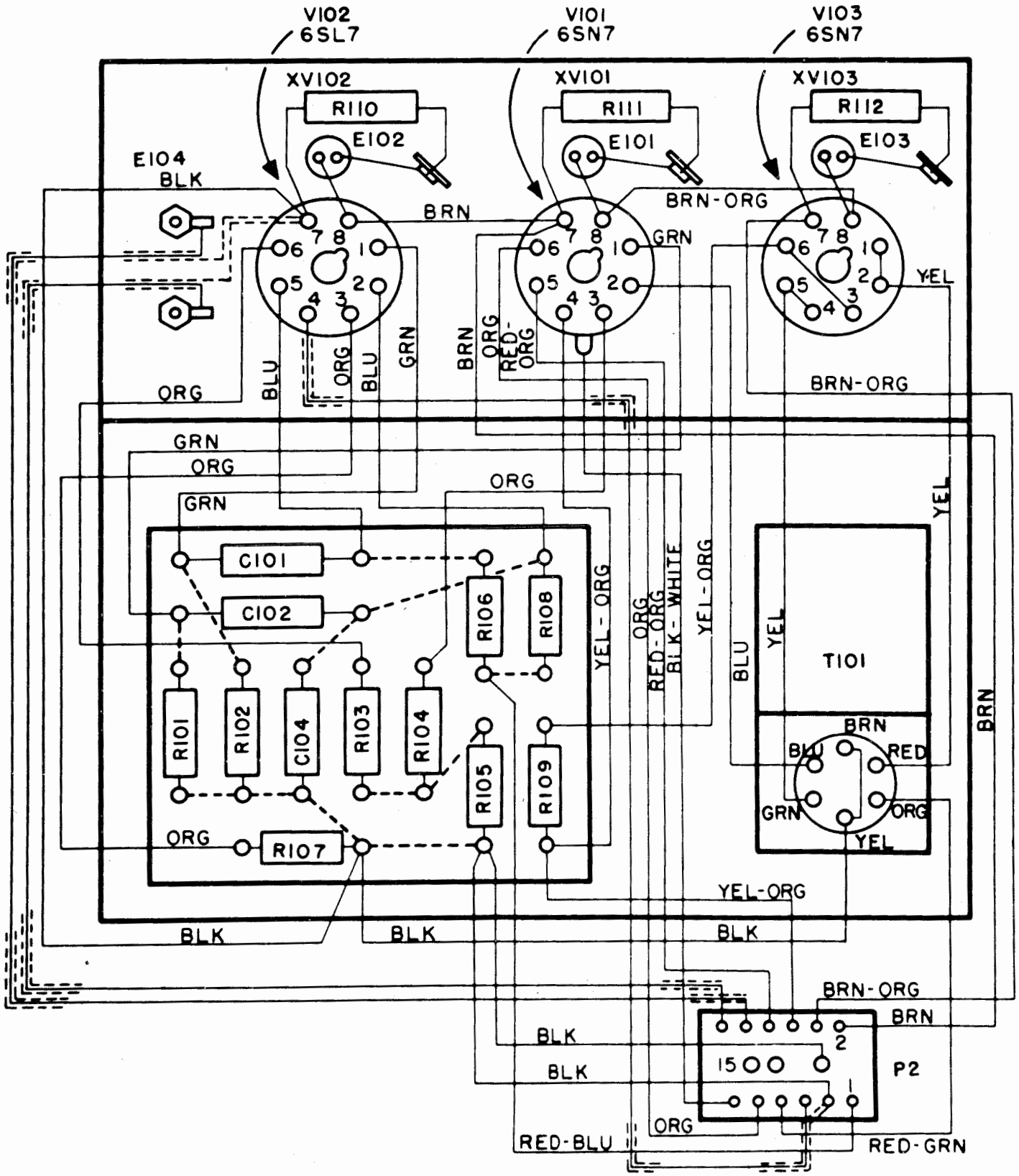


Figure 7–2. Location of Parts and Wiring Diagram of Amplifier-Detector Subassembly

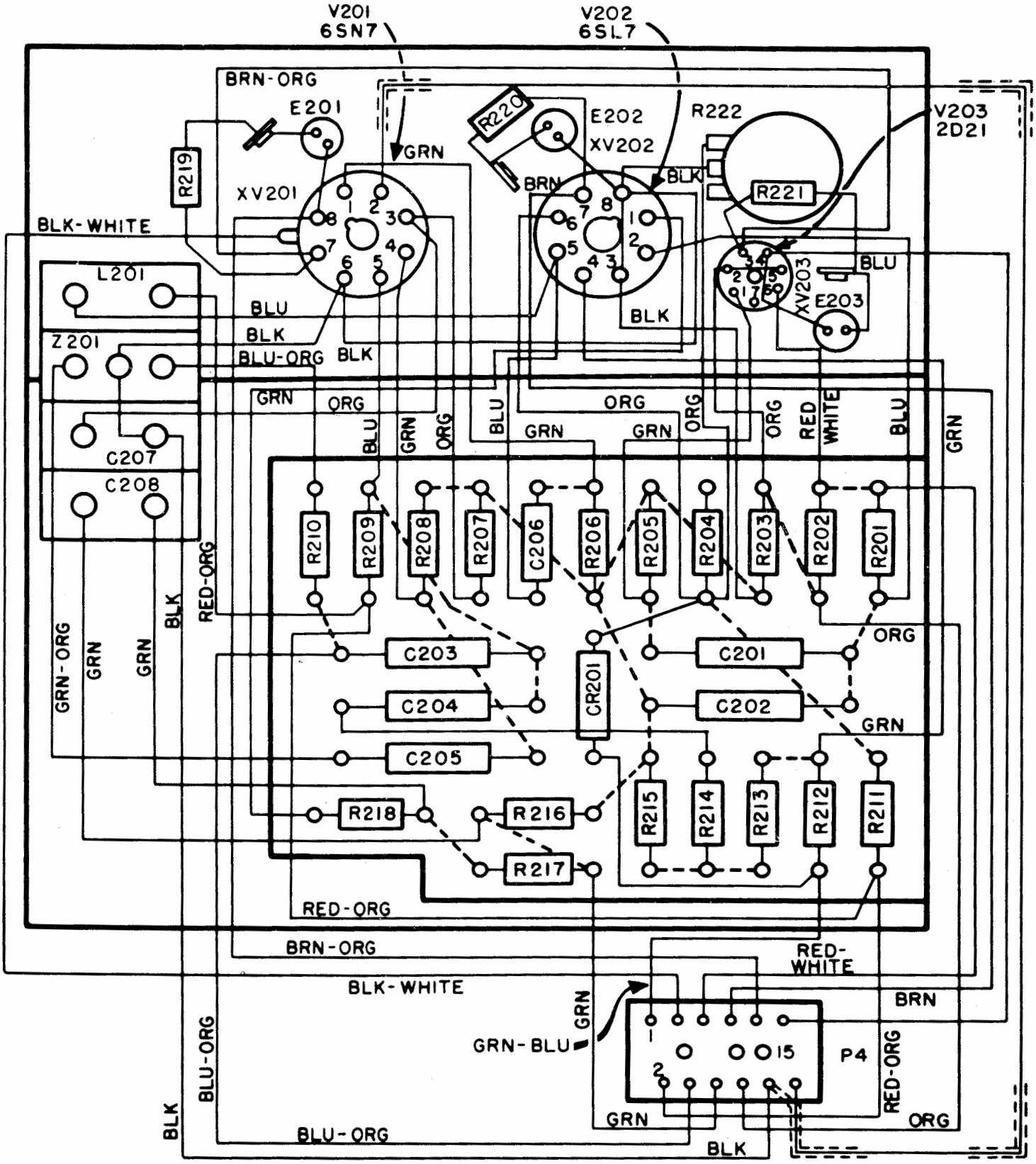


Figure 7–3. Location of Parts and Wiring Diagram of Amplifier-Modulator Subassembly

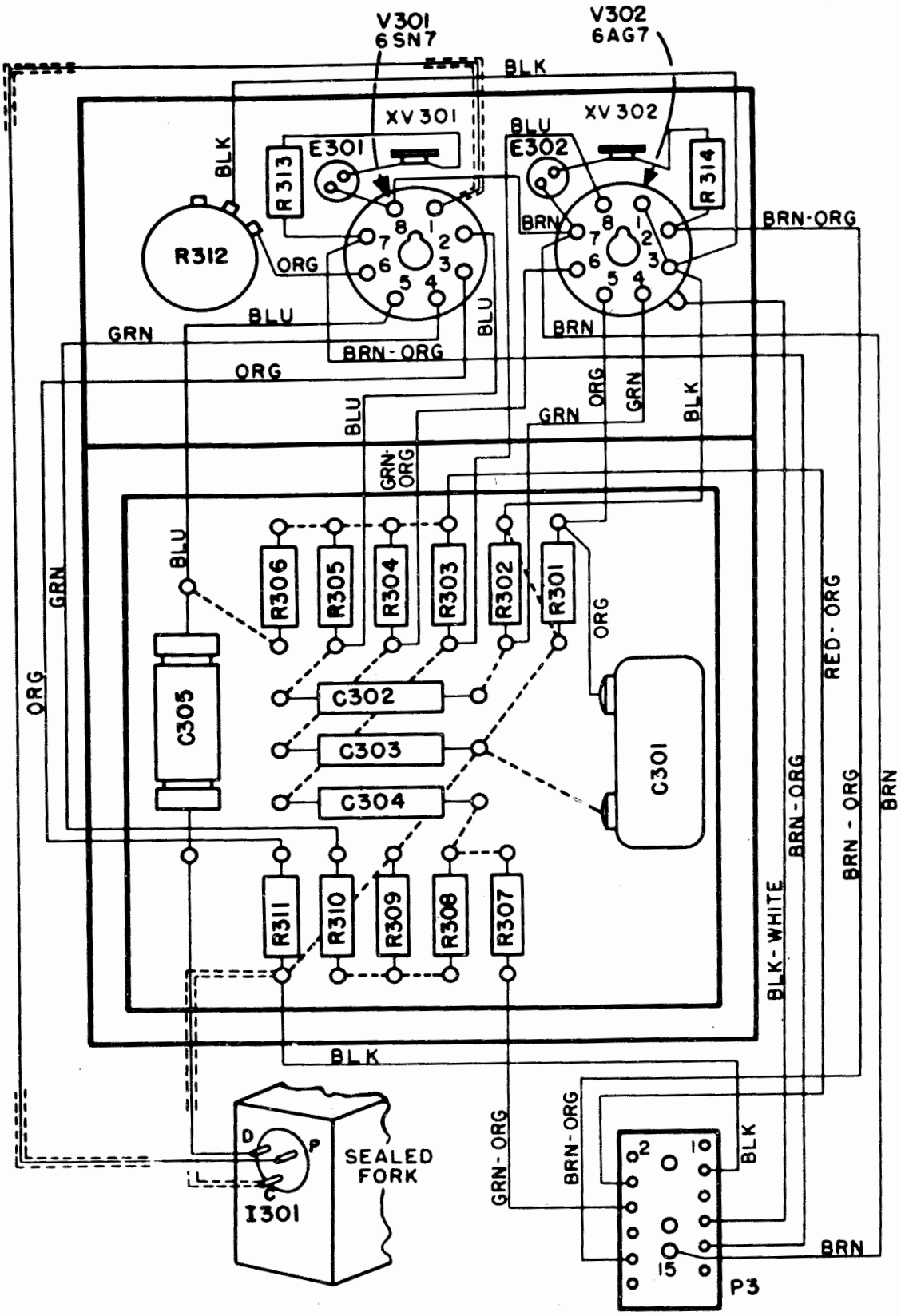


Figure 7–4. Location of Parts and Wiring Diagram of Audio-Frequency Oscillator Subassembly

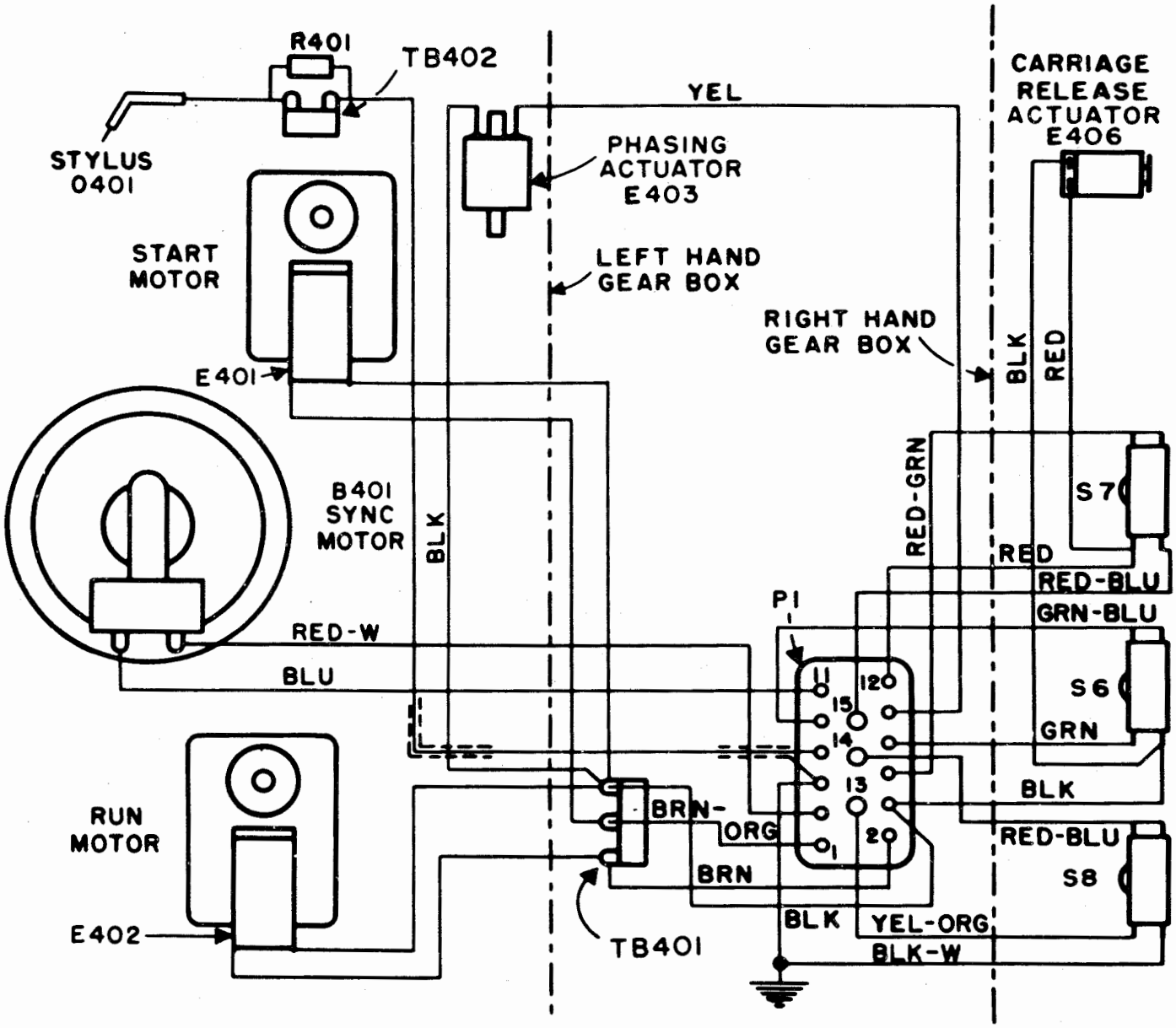


Figure 7–5. Location of Parts and Wiring Diagram of Recorder Subassembly

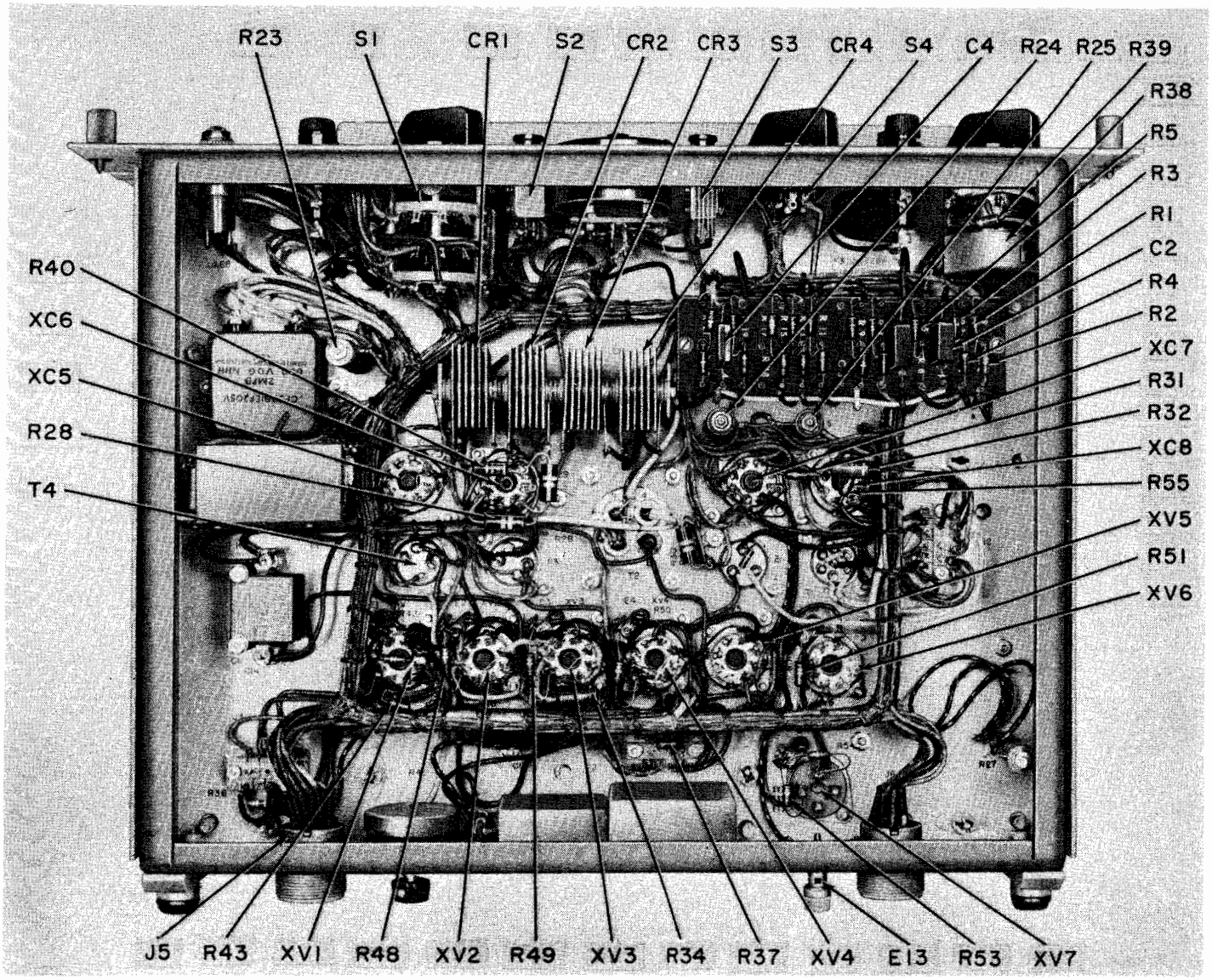


Figure 7–6. Bottom View of Amplifier-Power Supply Chassis

The values of resistors and capacitors for the plug-in subassemblies are listed in Table 7–2.

TABLE 7–2. RESISTOR AND CAPACITOR VALUES FOR PLUG-IN SUBASSEMBLIES

AMPLIFIER-DETECTOR. (See figure 7–2.)

SYMBOL	JAN DESIGNATION	VALUE	WVDC
C101	CN35A103K	0.01mf ±10%	600V
C102	CN35A103K	0.01mf ±10%	600V
C104	CN35A103K	0.01mf ±10%	600V
		OHMS	WATTS
R101	RC20BF274K	270K ±10%	½W
R102	RC20BF274K	270K ±10%	½W
R103	RC20BF470K	47 ±10%	½W
R104	RC20BF222K	2.2K ±10%	½W
R105	RC20BF101K	100 ±10%	½W
R106	RC20BF104K	100K ±10%	½W
R107	RC20BF222K	2.2K ±10%	½W
R108	RC20BF104K	100K ±10%	½W
R109	RC20BF103K	10K ±10%	½W

AMPLIFIER-MODULATOR. (See figure 7–3.)

SYMBOL	JAN DESIGNATION	VALUE	WVDC
C201	CN35A103K	0.01mf ±10%	600V
C202	CN35A103K	0.01mf ±10%	600V
C203	CN35A103K	0.01mf ±10%	600V
C204	CN35A103K	0.01mf ±10%	600V
C205	CN35A103K	0.01mf ±10%	600V
C206	CM20A511J	510mmf ±5%	500V
C207	CP53BIEF504V	0.5mf +20% −10%	600V
C208	CP53BIEF504V	0.5mf +20% −10%	600V
		OHMS	WATTS
R201	RC20BF474K	470K ±10%	½W
R202	RC20BF274K	270K ±10%	½W
R203	RC40BF683K	68K ±10%	2W
R204	RC20BF471K	470 ±10%	½W
R205	RC20BF105K	1Meg ±10%	½W
R206	RC20BF104K	100K ±10%	½W
R207	RC20BF222K	2.2K ±10%	½W
R208	RC20BF274K	270K ±10%	½W
R209	RC20BF473K	47K ±10%	½W
R210	RC20BF473K	47K ±10%	½W
R211	RC20BF153K	15K ±10%	½W
R212	RC20BF474K	470K ±10%	½W
R213	RC20BF185K	1.8Meg ±10%	½W
R214	RC20BF274K	270K ±10%	½W
R215	RC20BF394K	390K ±10%	½W
R216	RC20BF472K	4.7K ±10%	½W
R217	RC20BF104K	100K ±10%	½W
R218	RC20BF103K	10K ±10%	½W
R219	RC20BF274K	270K ±10%	½W
R220	RC20BF274K	270K ±10%	½W
R221	RC20BF274K	270K ±10%	½W
R222	Wire wound potentiometer	2000 ±10%	2W

The values of resistors and capacitors for the plug-in subassemblies are listed in Table 7-2.

TABLE 7-2. RESISTOR AND CAPACITOR VALUES FOR PLUG-IN SUBASSEMBLIES

AMPLIFIER-DETECTOR. (See figure 7-2.)

SYMBOL	JAN DESIGNATION	VALUE	WVDC
C101	CN35A103K	0.01mf ±10%	600V
C102	CN35A103K	0.01mf ±10%	600V
C104	CM20A511J	510mmf ± 5%	500V
		OHMS	WATTS
R101	RC20BF274K	270K ±10%	½W
R102	RC20BF274K	270K ±10%	½W
R103	RC20BF470K	47 ±10%	½W
R104	RC20BF222K	2.2K ±10%	½W
R105	RC20BF101K	100 ±10%	½W
R106	RC20BF104K	100K ±10%	½W
R107	RC20BF222K	2.2K ±10%	½W
R108	RC20BF104K	100K ±10%	½W
R109	RC20BF103K	10K ±10%	½W

AMPLIFIER-MODULATOR. (See figure 7-3.)

SYMBOL	JAN DESIGNATION	VALUE	WVDC
C201	CN35A103K	0.01mf ±10%	600V
C202	CN35A103K	0.01mf ±10%	600V
C203	CN35A103K	0.01mf ±10%	600V
C204	CN35A103K	0.01mf ±10%	600V
C205	CN35A103K	0.01mf ±10%	600V
C206	CM20A511J	510mmf ±5%	500V
C207	CP53BIEF504V	0.5mf +20% −10%	600V
C208	CP53BIEF504V	0.5mf +20% −10%	600V
		OHMS	WATTS
R201	RC20BF474K	470K ±10%	½W
R202	RC20BF274K	270K ±10%	½W
R203	RC40BF683K	68K ±10%	2W
R204	RC20BF471K	470 ±10%	½W
R205	RC20BF105K	1Meg ±10%	½W
R206	RC20BF104K	100K ±10%	½W
R207	RC20BF222K	2.2K ±10%	½W
R208	RC20BF274K	270K ±10%	½W
R209	RC20BF473K	47K ±10%	½W
R210	RC20BF473K	47K ±10%	½W
R211	RC20BF153K	15K ±10%	½W
R212	RC20BF474K	470K ±10%	½W
R213	RC20BF185K	1.8Meg ±10%	½W
R214	RC20BF274K	270K ±10%	½W
R215	RC20BF394K	390K ±10%	½W
R216	RC20BF472K	4.7K ±10%	½W
R217	RC20BF104K	100K ±10%	½W
R218	RC20BF103K	10K ±10%	½W
R219	RC20BF274K	270K ±10%	½W
R220	RC20BF274K	270K ±10%	½W
R221	RC20BF274K	270K ±10%	½W
R222	Wire wound potentiometer	2000 ±10%	2W

TABLE 7–2. RESISTOR AND CAPACITOR VALUES FOR PLUG-IN SUBASSEMBLIES (Continued)

AUDIO FREQUENCY OSCILLATOR. (See figure 7–4.)

SYMBOL	JAN DESIGNATION	VALUE	WVDC
C301	CP53B1EF504V	0.5mf +20% −10%	600V
C302	CN35A103K	0.01mf ±10%	600V
C303	CN35A103K	0.01mf ±10%	600V
C304	CN35A103K	0.01mf ±10%	600V
C305	CP25A1EF104M	0.1mf ±20%	600V
		OHMS	WATTS
R301	RC20BF222K	2.2K ±10%	½W
R302	RC20BF104K	100K ±10%	½W
R303	RC20BF104K	100K ±10%	½W
R304	RC20BF274K	270K ±10%	½W
R305	RC20BF104K	100K ±10%	½W
R306	RC20BF473K	47K ±10%	½W
R307	RC20BF274K	270K ±10%	½W
R308	RC20BF104K	100K ±10%	½W
R309	RC20BF473K	47K ±10%	½W
R310	RC20BF104K	100K ±10%	½W
R311	RC20BF222K	2.2K ±10%	½W
R312	Wire wound potentiometer	20,000 ±10%	3W
R313	RC20BF274K	270K ±10%	½W
R314	RC20BF274K	270K ±10%	½W

(*b*) RESISTANCE AND VOLTAGE MEASUREMENTS.—If the trouble appears to be electrical in nature and cannot be located from the meter readings at the various CIRCUIT TEST positions or by replacing plug-in subassemblies, the recorder must be removed from the cabinet for resistance and voltage measurements.

When making resistance measurements, be sure that the power plug is removed from the a-c outlet and that controls are set as indicated in the socket resistance measurements chart, Table 7–3.

Before making voltage measurements, connect the recorder chassis to a known ground. All measurements are made to B− (pin 1 of XC8) unless otherwise specified. See socket voltage measurements chart, Table 7–4.

When making voltage measurements, use extreme caution to prevent coming in contact with the high potential points in the electrical circuit.

VOLTMETER DATA

Except as otherwise indicated, all voltages apply to actual readings obtained when using a 1,000-ohms-per-volt voltmeter, whose maximum scale reading is not more than approximately three times the value given in the voltage table.

TABLE 7-3. SOCKET RESISTANCE MEASUREMENTS

TEST CONDITIONS

Selector switch in STANDBY.
Power plug out of a-c socket.
All measurements made to B- (pin 1 of XC8).
All readings are in ohms.

SYMBOL	PIN NUMBERS							
	1	2	3	4	5	6	7	8
XV1	90K	68K	0	255K	50K	500 (d) to 5.5K	11	13
XV2	0	15	50K	300	300	50K	12	100
XV3	0	16	50K	300	300	50K	15	100
XV4	NC	19	50K	0	0	50K	18	0
XV5	NC	0	NC	NC	5K	NC	NC	NC
XV6	NC	70	NC	NC	NC	NC	50	NC
XV7	50	50	0	20	—	—	—	—
XC5	180K	0	80K	NC	78K	NC	78K	NC
XC6	0	50K	50K	NC	50K	100K	50K	—
XC7	0	NC	5K	NC	91K (a)	2K	20K	NC
XC8	0	8.2	150K	10K	5K	NC	10K	0
XV101	250K	10K	2.3K	2.5K	5K	20K (b)	2	4
XV102	250K	120K	2.2K	1200	120K	100	0	2
XV103	400	400	15K	650	650	15K	5	3.5
XV201	100K	50K	2.2K	270K	50K	0	5	7
XV202	110K	500K	0	325K	6K	1K (e)	1	0
XV203	1 meg.	50K	8	11	50K	50K	50K	—
XV301	1.4K	100K	2.2K	135K	50K	0 to 20K (c)	7	9
XV302	0	12	0	100K	2.2K	270K	10	100K

NOTES

(a) Selector switch in RUN position.
(b) CIRCUIT TEST in SIG AMP OUT and PRESS TO TEST switch depressed.
(c) Reading depends on potentiometer setting (R312).
(d) Reading depends on potentiometer setting (R41).
(e) Reading depends on potentiometer setting (R222).
NC = no connection.

TABLE 7–4. SOCKET VOLTAGE MEASUREMENTS

TEST CONDITIONS

Readings taken on 1000-ohms-per-volt meter from tube or capacitor pin to B–.
Selector switch in RUN position. 117-volt, 60-cycle, a-c input.

SYMBOL	PIN NUMBERS							
	1	2	3	4	5	6	7	8
XV1 (6SN7)	–1	–18	0	0	320	14 (a)	45 ac	51.5 ac
XV2 (1635)	0	58 ac	320	–2.5	–2.5	320	51.5 ac	0.4
XV3 (1635)	0	64.5 ac	320	–2.5	–2.5	320	58 ac	0.4
XV4 (1635)	—	71 ac	320	0	0	320	64.5 ac	0
XV5 (VR75)	—	0	—	—	75	—	—	—
XV6 (2H20)	—	75	—	—	—	—	117 ac	—
XV7 (6–36)	117 ac	117 ac	0	71 ac	—	—	—	—
XC5	0	0	250	—	250	—	250	—
XC6	0	330	330	—	350	350	350	—
XC7	0	135	135	—	0	40	90	—
XC8	0	4	120	100	120	—	100	0
XV101 (6SN7)	0	100	3.5	1.4	75	10	6.4 ac	13 ac
XV102 (6SL7)	0	25	0.5	0	21	0.8	0	6.4 ac
XV103 (6SN7)	0	0	18	0	0	18	19 ac	13 ac
XV201 (6SN7)	0	330	11	0	28	0	25 ac	32 ac
XV202 (6SL7)	–0.5	19	0	0	60	5 (b)	6.4 ac	0
XV203 (2D21)	0	25	25.5 ac	19 ac	25	280	—	—
XV301 (6SN7)	0	15	0.8	0	26	2.8 (c)	32 ac	38.5 ac
XV302 (6AG7)	0	45 ac	0	0	1.0	10	38.5 ac	38

NOTES

(a) Varies with setting of SYNC MA control (R41).
(b) Varies with setting of BIAS control (R222).
(c) Varies with setting of R312.
Underlined readings are a-c.

b. REPAIR.—As the trouble shooting chart, Table 7–1, indicates, mechanical failure in the recorder subassembly is a major cause of faulty operation in the RD–92A/UX. If mechanical trouble exists, it must be cleared before the electrical circuits can be properly adjusted. The procedures given below are to be followed for removing and replacing the components of the recorder subassembly.

(1) REMOVING RECORDER SUBASSEMBLY.—To remove the recorder subassembly from the set, proceed as follows:

(*a*) Loosen the four knurled-head captive screws that hold the set in the cabinet. Remove the set from the cabinet.

(*b*) Remove the two hex-head screws at the top of the lower front panel that enter the channel under the drum.

(*c*) Loosen the two hex-head captive screws (56, figure 7–15) that bolt the recorder subassembly to the amplifier-power supply at the back of the channel under the drum.

(*d*) Place fingers under channel at the sides of the recorder chassis and work the entire channel and subassembly up and out.

(*e*) Place the subassembly on a flat working surface.

(2) REMOVING DRUM.—If the mechanical trouble is such that the drum must be removed, proceed as follows:

(*a*) Remove the recorder subassembly as given in (1) above.

(*b*) Lower the antiradiation screen, and unscrew the two Phillips-head screws that attach the paper load blade (5, figure 7–16) and the screen chains to the front panel. Remove the paper load blade and the chains.

(*c*) For convenience in working, the antiradiation screen may be removed as follows:

1. Unscrew the screen hinges from the front panel.

2. Unscrew the Phillips-head screw (3, figure 7–15) to which the lug of the screen ground strap is attached. Remove the lug and replace the screw.

(*d*) Remove the dust pan from under the drum by pulling straight out on both sides.

(*e*) Move the stylus carriage to the extreme right and lock it in place by depressing the RECORD button.

(*f*) Partially disassemble the right-hand gear box as follows. Refer to the exploded view of the gear box, figure 7–17.

1. Remove the six screws from the cover plate of the gear box. Remove the cover plate.

2. Remove the screw (2) that holds the switch lever assembly (1). Let the switch lever hang by its lower spring (4).

3. Using the truarc pliers, remove the retaining rings (21), (23), and (25) that hold the upper gears (20), (22), and (24) in place.

4. Remove the gears. *Do not remove the gears on the leadscrew or drum shafts.*

(*g*) Position the drum as though operating the paper clamp.

(*h*) Loosen the slide plate clamping screw, (9, figure 7–21) on the right end of the drum. Push the slide plate toward the edge of the drum, disengaging the drum from the shaft.

(*i*) Support the drum with the left hand. Grasp the drum shaft by the little gear on the end (1, figure 7–18) and, with a twisting motion, withdraw the shaft from the drum.

NOTE

If the drum shaft sticks and cannot be removed by pulling on its gear, carefully slide the drum along the shaft, hitting retaining ring (5, figure 7–18) briskly until bearing (3) is loosened. The drum shaft may then be easily removed.

(*j*) Remove the drum from the front of the recorder, freeing the right side first. Be careful not to damage the stylus during this operation.

(*k*) For reassembly, replace the drum in the recorder, placing the left side in first, then swinging in the right side. Be careful not to damage the stylus in this operation.

(*l*) Replace the drum shaft in the drum, taking care to line up the drive slot at the left side of the drum shaft. With the drum shaft aligned at the left, press in on the shaft and rotate it until it becomes engaged with the drive subassembly. Make certain that the bearing on the right end of the shaft is fully seated.

(*m*) Replace the gears, retaining rings, and switch lever in the reverse order of disassembly.

(*n*) Lock the drum to the drum shaft as follows:

1. Slide the drum to the right until it bears against the retaining ring on the drum shaft.

2. Then, while pressing the slide plate in toward the center of the drum, slowly rotate the drum shaft within the drum until the slide plate falls into poistion in its slot.

3. Tighten the slide plate clamping screw.

(3) REPLACING THRUST BEARING SPRING. —The compo thrust bearing springs attached to the right-hand gear box cover are a possible source of trouble. Inspect as follows:

(*a*) Remove the six screws from the cover plate of the right-hand gear box.

(*b*) Examine the two compo thrust bearings attached to the inside of the cover plate.

(*c*) Replace if worn or broken.

(*d*) Apply a dab of grease, Spec. 14–L–3, to the friction surfaces.

(*e*) Replace the cover plate and its six screws.

(4) DISASSEMBLY OF THE LEFT-HAND GEAR BOX.—The drum is first removed as described in paragraph 5*b*(2). Then proceed as follows:

(*a*) Remove the cover plate of the left-hand gear box:

1. Loosen the two binding-head screws on the top of the cover plate. Remove only the screw on the left.

2. Loosen the four Phillips-head screws on the left side of the front panel. Remove only the two screws on the left.

3. Remove the four binding-head screws on the left side of the gear box.

4. Remove the two binding-head screws on the rear of the gear box, above and below the synchronous motor.

5. Pull the cover plate to the left and slide it away from the casting.

(*b*) Remove the front panel as follows:

1. Remove the RECORD button knob on the right-hand gear box by taking out its set screw.

2. Remove the remaining Phillips-head screws from the front panel. There are two Phillips-head screws in the right-hand gear box and two in the left-hand gear box.

3. Remove the front panel.

(*c*) Expose the synchronous motor worm and worm wheel as follows. Refer to the exploded view of the left-hand gear box, figure 7–19.

1. Remove the four recessed screws (2) holding the bearing plate casting (1) on the left end of the gear box.

2. Pull out the bearing plate assembly. This exposes the synchronous worm and worm wheel (24).

3. Be sure to put aside all spacers for use in reassembly.

(*d*) Remove the drive subassembly (30) as follows. Refer to figure 7–19.

1. At the right side of the gear box, insert the special "T" wrench, H3, through the center of the bearing (29).

2. Engage the wrench with the retaining nut (31) and unscrew the nut.

3. Remove the drive subassembly (30).

(*e*) Remove the worm wheel assembly (24) as follows. Refer to figure 7–19.

1. Rotate the worm by hand until the set screw (26) in the clamp ring (25) faces the front of the gear box.

2. Loosen the set screw and remove the worm wheel assembly from its shaft.

(*f*) Remove the synchronous motor assembly as follows. Refer to figure 7–20.

1. Remove the retaining ring (2) from the sync motor shaft on the front of the gear box.

2. Unsolder the wires to the sync motor.

3. Withdraw the sync motor by pulling it away from the gear box.

(*g*) Remove the start motor rotor from within the start motor field coil assembly.

(*h*) Remove the gear box cover assembly by unhooking the draw string from the stylus carriage and untieing string from hook.

(*i*) The start motor field coil assembly may then be removed by taking out the two screws (53, figure 7–19) near the top of the motor and the one screw near the bottom (56, figure 7–19).

(5) REPLACING SYNCHRONOUS MOTOR COILS.—If the synchronous motor coils require replacement, proceed as follows:

(*a*) Remove the synchronous motor from the left-hand gear box, following instructions in paragraphs 5*b*(4) through (f).

(*b*) Mark the end bells of the synchronous motor before disassembling, so that later they may be reassembled in the same relative position to each other. When looking at the solid or terminal end of the motor with the terminals at 6 o'clock, the decoupling spring nut on the other bell should be at 9 o'clock.

(*c*) Remove the four round-head screws and nuts from the outside flange of the motor.

(*d*) Hold the motor in one hand and lightly tap the end of the motor shaft with a nonmetallic object until the two motor bells can be separated. Take note of the position of washers on the motor shaft, so that they can be properly positioned for reassembly later.

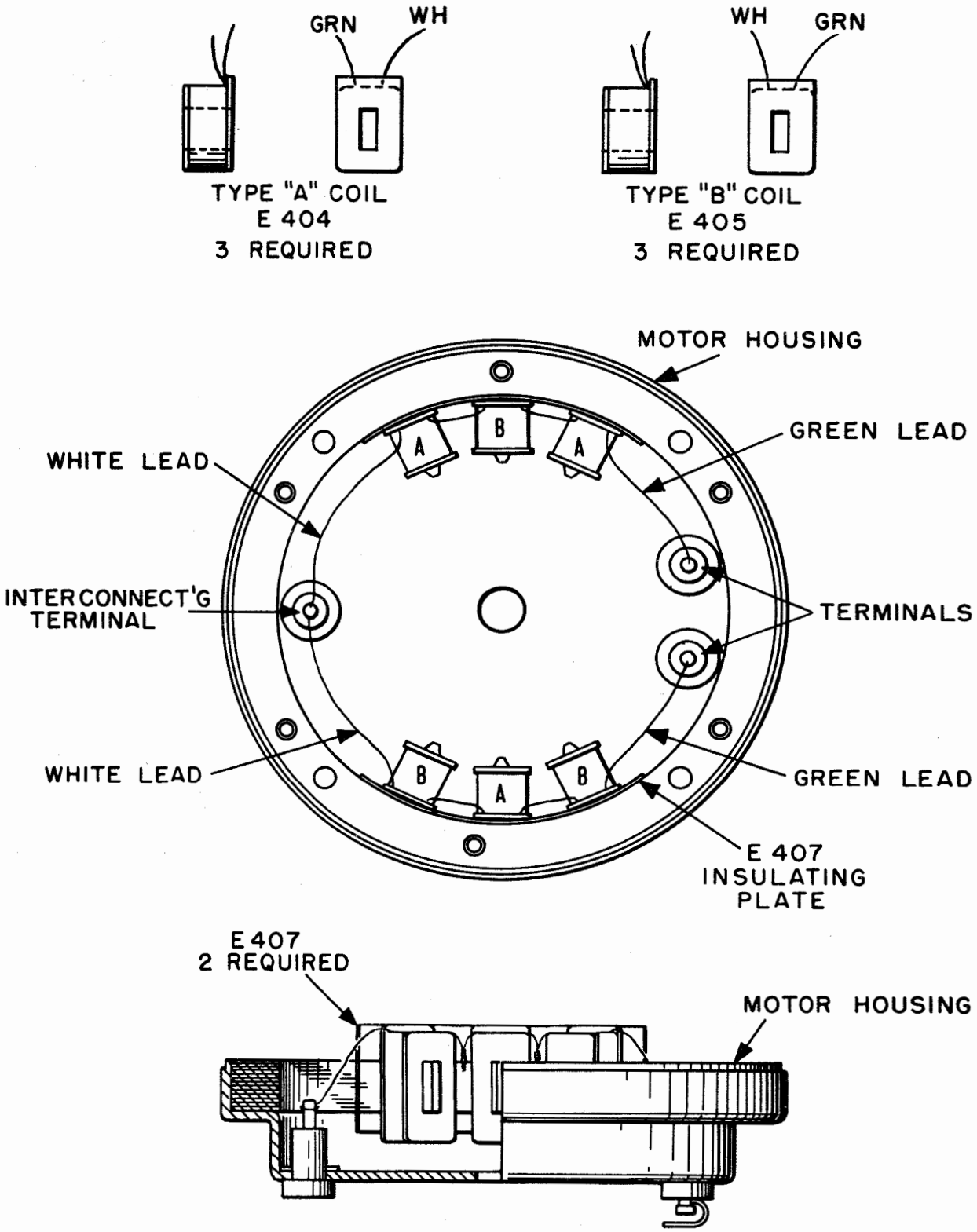


Figure 7–7. Identification and Connection of Synchronous Motor Coils

(*e*) Examine the inside of the terminal bell assembly. See figure 7–7. The six coils are arranged in two sets of three coils each, with the coils arranged alternately as "A" and "B" types. If a single coil is found to be defective, it is advisable to replace all three coils of the set.

(*f*) Remove the defective set of motor coils as follows:

1. Lift up the soldered leads between coils and cut them close to the coils.

2. Unsolder the leads from the input and interconnecting terminals.

3. Insert the blades of two thin-bladed screw drivers between the insulating plate and the laminations on each side of the bobbin close to the pole piece.

4. Gently pry off the coil from the pole piece, working the bobbins completely off, one at a time. Take care not to bend the pole piece either up or down or to separate the laminations.

5. Examine the insulating plate. If it is cracked, scorched, or otherwise damaged, the plate should be replaced.

6. Clean and remove all excess hardened varnish that may be left on the laminations.

(*g*) Select a replacement coil for each coil removed from the set, using the correct types "A" or "B" as indicated in figure 7–7. Identify the coils as follows:

1. Arrange the green and white leads so that they come out straight from the coil and are not twisted around each other. Hold the leads with the coil hanging down and facing away from the observer.

2. If the lead at the left is green, the coil is type "A" (E404). If the lead at the left is white, the coil is type "B" (E405).

(*h*) Install the replacement coils as follows:

1. Push the coils onto their respective pole pieces with the leads coming up from the top of each coil and away from the rotor. The coil should fit snugly on the pole piece.

2. If a coil fits loosely on its pole piece, insert a flat toothpick or piece of wood as a wedge in the space between the sides of the pole piece and the window of the coil form. Make sure that the end of the wooden wedge does not extend beyond the coil form.

3. Apply a small amount of insulating varnish to keep the coil in place.

4. Reconnect leads by soldering together the same color leads of adjacent coils. Keep the leads short and away from the space occupied by the rotor.

5. Connect two white leads to the interconnecting terminal, as shown in figure 7–7 and two green leads to the input terminals.

6. Apply insulating varnish to all soldered connections.

7. Bend the soldered joints down into the space between the coils, making sure that the joint and its leads are clear of the casting and the coils.

8. Allow the varnish to dry for three or four hours under a 100-watt lamp placed about three inches away from the center of the bell assembly.

9. Thoroughly clean off any varnish from the projecting pole pieces or pole faces.

(*i*) Reassemble the two bells, replacing all washers in their original position as noted in step (*d*). Be careful to realign the bells as noted in step (*b*).

(*j*) Replace the four screws which hold the motor together, making them hand-tight only.

(*k*) Spin the motor by hand and, holding it close to your ear, listen for any evidence of the rotor hitting the pole faces.

(*l*) If the motor does not turn freely, disassemble, determine the cause of trouble, and correct it.

(*m*) If the motor turns freely, tighten the screws alternately to 5½ – 6 inch-pounds torque. This is equivalent to a one-quarter to one-half turn beyond the snug condition.

(*n*) Retest the motor for free spinning and free coasting.

(*o*) Reinstall the left-hand gear box motor and the drum in the reverse order of disassembly. Refer to paragraphs 7–5*b*(2) and (4).

(6) REPLACING PHASING ACTUATOR.—See figure 7–19.

(*a*) Remove the drum, following the instructions given in paragraph 7–5*b*(2).

(*b*) Remove the hood (59) attached to the left-hand gear box covering the phasing actuator. Note the arangement of the wires to the coil, in order to reconnect them properly when reassembling.

(*c*) Unscrew the phasing actuator (62) from the gear box casting and unsolder the leads to the coil.

(*d*) Solder the leads of the replacement actuator and screw it loosely to the casting.

(*e*) Position the actuator so that with the armature in the energized position a 0.005-inch feeler gauge will just fit between the armature and the stop bar (32) on the drive subassembly (30).

(*f*) Tighten the holding screws to 7 inch-pounds torque. This setting should allow a 0.016-inch interference between the armature and the stop bar when the actuator is not energized.

(7) REPLACING COUPLING SECTION.—Refer to figure 7–21.

(*a*) If the coupling section (1) sticks, clean it without removing the drum from the recorder. If the trouble is not remedied, remove the drum as described in paragraph 7–5*b*(2).

(*b*) If any of the three springs are defective, it is best to replace the assembly.

CAUTION

Before removing the defective assembly, trace an outline in pencil of its position on the drum. Place the replacement assembly in the same position. If necessary, shift the phasing position of the drum by sliding the assembly in the slotted hole. Tighten the screw (2) securely to prevent the assembly from shifting position.

(*c*) As a temporary expedient, the springs may be repaired or replaced with materials available. If temporary repairs are made, the top spring should be very light and the bottom springs should be very heavy.

(8) REPLACING CARRIAGE.—If the entire carriage assembly must be replaced, proceed as follows. Refer to figure 7–15.

(*a*) Remove the drum, following instructions in paragraph 7–5*b*(2).

(*b*) Remove the front panel, following instructions in paragraph 7–5*b*(4)(*b*).

(*c*) Detach the string from the carriage.

(*d*) Remove the two screws in the front (24) and the two screws in the rear (25) that hold the right-hand gear box casting to the channel.

(*e*) Pivoting it at the bottom, swing the right-hand gear box casting to the right. See figure 7–8. Note that the lead screw assembly and the cam rod remain attached to the right-hand gear box and the trolley rod remains attached to the left-hand gear box.

(*f*) Remove defective carriage assembly from the left end of the lead screw and the cam rod. Put on replacement.

(*g*) Reassemble in reverse order of disassembly.

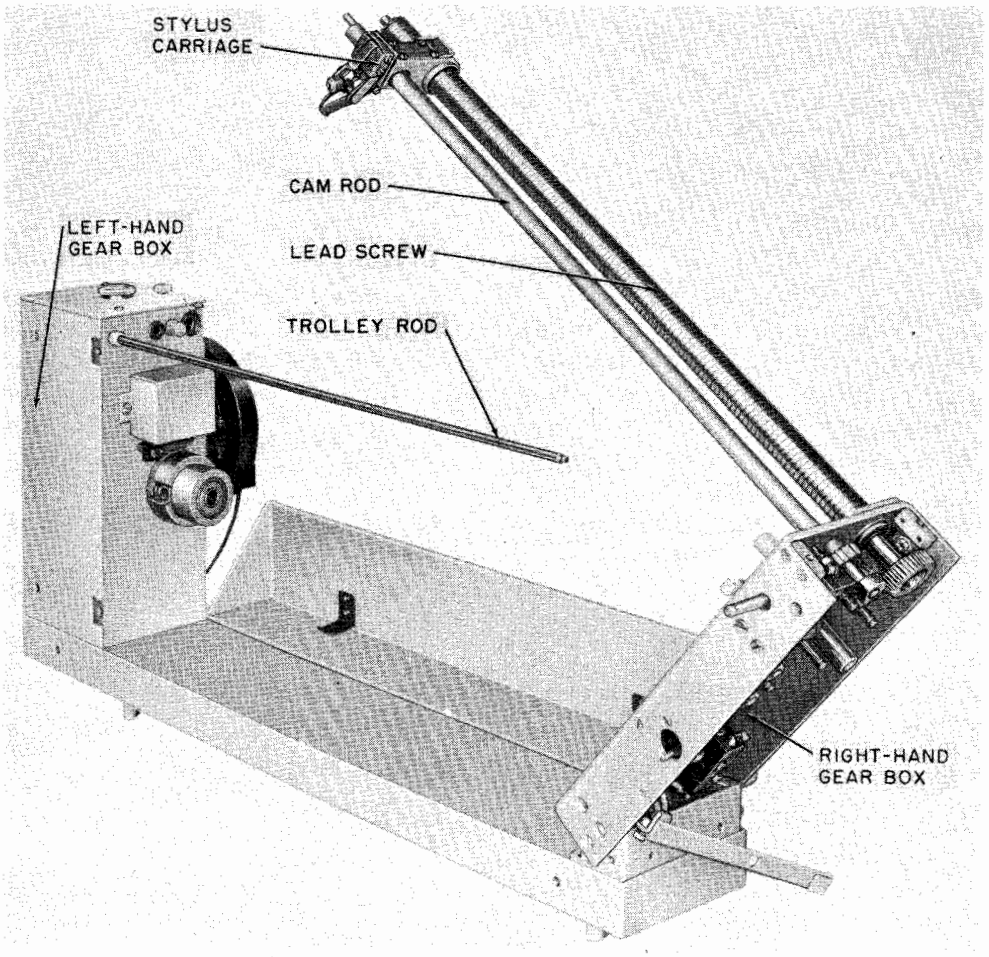


Figure 7–8. Separation of Right- and Left-hand Gear Boxes Prior to Carriage Removal

(9) REPLACING CARRIAGE RETURN SPRING. —See figure 7–22.

(*a*) Be sure that the power cord is disconnected from the a-c outlet.

(*b*) Slide the recorder out of its cabinet to the roller stops.

(*c*) Remove the two screws holding the left-hand gear box cover.

(*d*) Remove the gear box cover.

(*e*) Remove the nut (3) holding the spring to the cover. Put aside spacers for reassembly.

(*f*) Unwind the string on the spring and cut as close as possible to the knot holding the string to the spring.

(*g*) Attach the string to the replacement spring.

(*h*) Wind the string around the replacement spring.

(*i*) Attach the spring to the cover with the nut removed in step (*e*). Be sure to replace the spacers.

(*j*) Replace the gear box cover, using the screws removed in step (*c*).

(*k*) Adjust tension on the spring following instructions given in paragraph (10) below.

(10) ADJUSTING CARRIAGE RETURN SPRING.—Be sure that the lead screw, the half nut, and the cam rod are cleaned thoroughly before adjusting the tension of the carriage return spring.

(*a*) Slide the equipment out of the cabinet to its stops.

(*b*) Detach the string from the carriage.

(*c*) Hold the knurled spring screw firmly and remove the two screws which hold it in place.

(*d*) Adjust the spring to 8 to 12 ounces of tension with the string extended 12 inches. To increase tension, turn the knurled spring screw counterclockwise. To decrease tension, turn clockwise.

(*e*) Replace and tighten the screws in the cap.

(*f*) Replace the string on the carriage.

(*g*) Check to be sure the carriage returns with a "snap".

(11) REMOVING HALF NUT.—See figure 7–23. If it becomes necessary to remove the half nut (6) for cleaning or repair, proceed as follows:

(*a*) Check to see that the RECORD button is in the outward position.

(*b*) Remove the four screws (2) on the top of the stylus carriage assembly. Carefully roll the nylon strip (4) out of the way.

(*c*) Lift the half nut out of the opening.

(*d*) Clean the half nut with a nylon tooth brush and wash with soapy water. Dry the half nut thoroughly.

(*e*) Replace in the reverse order of disassembly.

(12) REPLACING PAPER GUIDE.—If the paper guide requires replacement, proceed as follows. Refer to figure 7–23.

(*a*) Turn off power to the recorder.

(*b*) Slide the recorder out of its cabinet to the roller stops.

(*c*) Slide the stylus carriage to the middle of the lead screw and depress the RECORD button to lock it in position.

(*d*) Hold the paper guide (13) and remove the screw (11) holding it to the stylus carriage.

(*e*) Replace the paper guide and tighten the replacement in position, using the screw removed in step (*d*).

(13) POSITIONING THE PAPER GUIDE.—If the paper guide is not properly positioned, proceed as follows:

(*a*) With the power off and the recorder out of its cabinet to the roller stops, slide the stylus carriage to the middle of the lead screw and depress the RECORD button to lock it in place.

(*b*) Insert a screw driver in the slot of the paper guide holder (15, figure 7–23) and rotate the holder to position the paper guide, so that the sapphire bearing at the end of the paper guide is $\frac{1}{32}$ inch from the drum surface.

c. ELECTRICAL ADJUSTMENTS.—There are very few electrical adjustments that must be made. The settings of the DENSITY control on the front panel and the SYNC MA control at the rear of the recorder, however, need to be checked occasionally for normal operation.

The BIAS control on the amplifier-modulator and the fork frequency control may need adjustment. These controls are not to be touched, however, unless these circuits are definitely known to be out of adjustment.

(1) NORMAL OPERATING ADJUSTMENTS.

(*a*) ADJUSTING SYNC MA CONTROL (R41).—Check and adjust SYNC MA control as follows:

1. Turn on equipment and, following normal operating procedure, turn selector switch to SYNC position.

2. Turn the CIRCUIT TEST switch to SYNC MA position.

3. Depress the PRESS TO TEST switch.

4. Adjust the SYNC MA control at the rear of the recorder so that the front panel meter reads 100 $\pm$10.

(*b*) ADJUSTING DENSITY CONTROL (R38).—This adjustment controls the gain of the signal amplifier so that the proper d-c voltage is obtained

to key the print oscillator signal. Incorrect setting of the DENSITY control may cause faulty recording.

Adjust the DENSITY control as follows:

1. Turn on the recorder following normal operating procedure up to SYNC position. Wait until steady, maximum-level facsimile signals or phasing signals are being received.

2. Start the DENSITY control near zero and advance the control to the lowest point that will give the maximum reading on the front panel meter. This meter reading is normally 100 ±10.

3. For some types of copy it is desirable to advance the dial setting of the DENSITY control slightly beyond the lowest point that will give maximum meter reading. Try this procedure if the recorded copy is too light. Leave the DENSITY control at the setting that gives best recording.

(2) CORRECTIVE ADJUSTMENTS.—The following adjustments are to be made only when it is definitely known that the associated circuits are not functioning properly.

CAUTION

Do not make the adjustments outlined below without proper authorization.

(*a*) ADJUSTING BIAS CONTROL (R222).—This control, located on the amplifier-modulator subassembly, adjusts the bias applied to the cathode of the modulator tube. The operating contrast of the recorder can be set from 8 to 15 db by the BIAS control. The factory adjustment is for 12 db. If readjustment becomes necessary, proceed as follows:

1. Turn the BIAS control to its midposition.

2. Turn the selector switch to SYNC position, as in normal operating procedure.

3. Connect an 1800-cycle signal of about 0.1 ±0.025 volts from a signal generator such as Audio Oscillator TS–382A/U or higher to the input terminals of the recorder.

NOTE

Signal level readings are normally available on the signal generator used as an external signal source. Otherwise a separate meter such as Electronic Multimeter ME–6/U series together with Audio Oscillator Navy model LAJ series can be used.

4. Adjust the DENSITY control for optimum recording as described in paragraph 7–5*c*(1)(*b*).

5. Reduce the level of the 1800-cycle input signal until the recording has the desired contrast.

6. Adjust the BIAS control until the front panel meter reads zero.

7. Increase the level of the external 1800-cycle signal to the original signal level (step *3* above) and again adjust the DENSITY control for optimum recording.

8. Repeat steps *3*, *4*, *5*, *6*, and *7* until the desired contrast is obtained. This is indicated by a meter reading of zero at minimum signal level and 100 ±10 at 0.1 volt signal level.

(*b*) ADJUSTING FORK FREQUENCY CONTROL (R312).—The fork controlled audio-frequency oscillator generally does not require any adjustment. *Do not touch the adjustment control until it is absolutely established that the oscillator is off frequency.*

Station WWV of the National Bureau of Standards transmits signals that can be used for checking and adjusting the fork frequency. A pulse occurring once each second modulates transmissions at 2.5, 5, 10, 15, 20, 25, 30, and 35 mc. To check the fork frequency against this standard, proceed as follows:

1. Tune a radio receiver to a WWV transmission and adjust the volume control to accentuate the pulse occurring once each second.

2. Connect the output of the receiver to the input terminals of the recorder.

3. Slide the recorder out of its cabinet to the roller stops.

4. Turn on the recorder and record about one inch of copy.

5. Turn the selector switch to SYNC.

6. After 20 minutes, turn the recorder to RUN.

7. Slide the stylus carriage to the point where recording was stopped in step *5*, above and depress RECORD button.

WARNING

DO NOT TOUCH THE TROLLEY ROD. HIGH POTENTIALS EXIST.

8. Record another inch of copy.

9. Examine the copy. If the fork is exactly on frequency, the pulse recording will line up exactly with the previous recording. If frequency shift (skew) exists, the new pulse line will be above or below the first one.

When the new pulse line is below the first one, the frequency of the fork oscillator is less than 1800 cycles. If the new pulse line is above the first line, the frequency of the fork oscillator is greater than 1800 cycles.

(*c*) ADJUSTING FORK FREQUENCY.

1. Check the fork frequency as outlined above.

2. Measure the displacement. With a 20-minute interval between the first and second pulse line, the error (skew) is recorded in inches per foot.

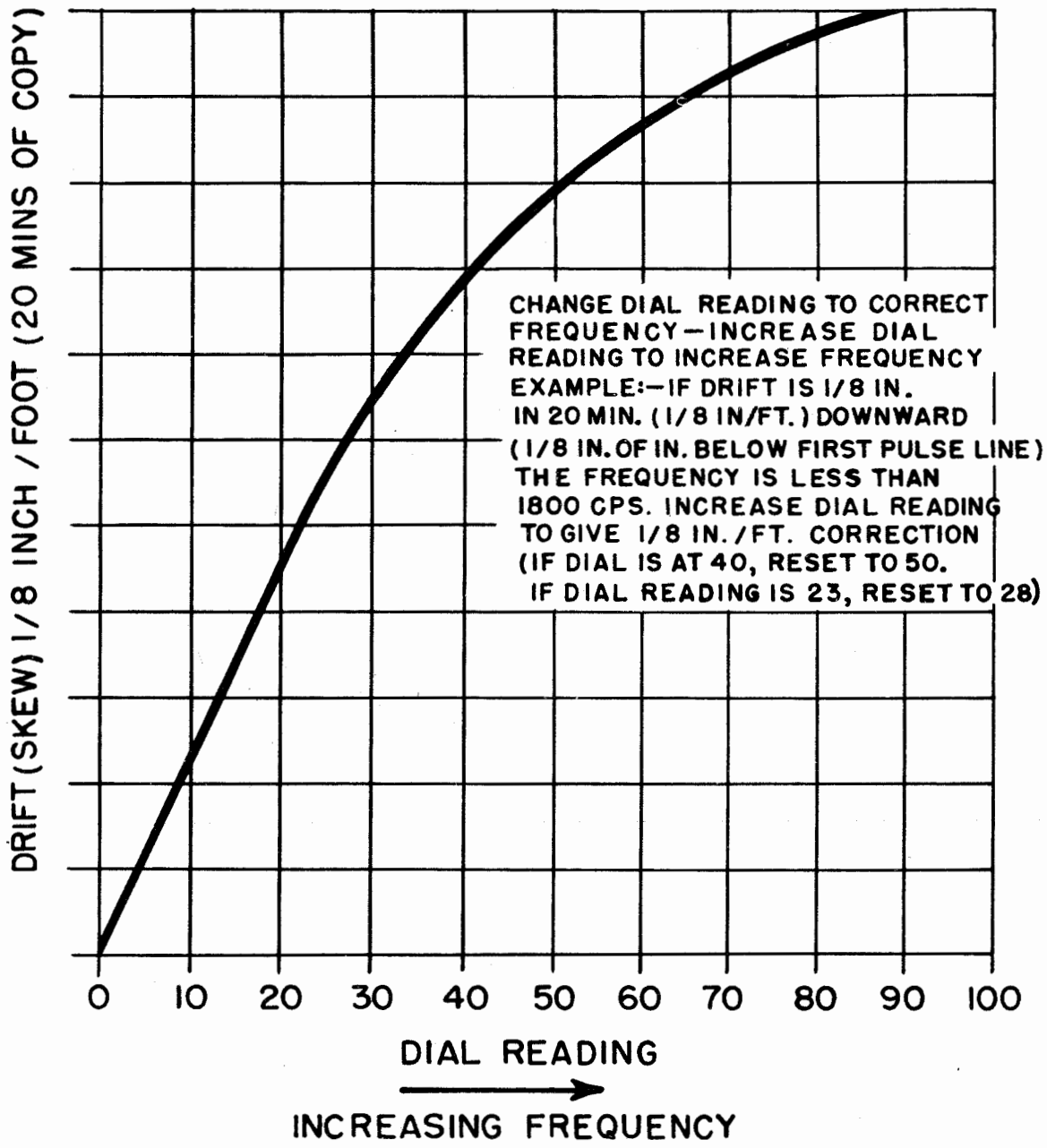


Figure 7–9. Fork Frequency Correction Chart.

3. If the displacement is more than one eighth of an inch, use the correction chart of figure 7–9 and make the required adjustment of the fork frequency control to obtain the corrected dial reading.

4. Recheck the fork frequency, to be sure that the correct frequency setting has been obtained.

(3) CALIBRATION OF CIRCUIT TEST CIRCUITS. See schematic diagram of test circuits, figure 7–1. In order to obtain a uniform test reading of 100 for the various positions of the CIRCUIT TEST switch, it is necessary to include a correcting resistor (marked *) in each circuit. A resistor is selected which will result in the desired uniform meter reading under normal test conditions. One-half watt carbon resistors, with a tolerance of plus or minus 10 per cent, are used. There is no need for precision adjustment of the cir-

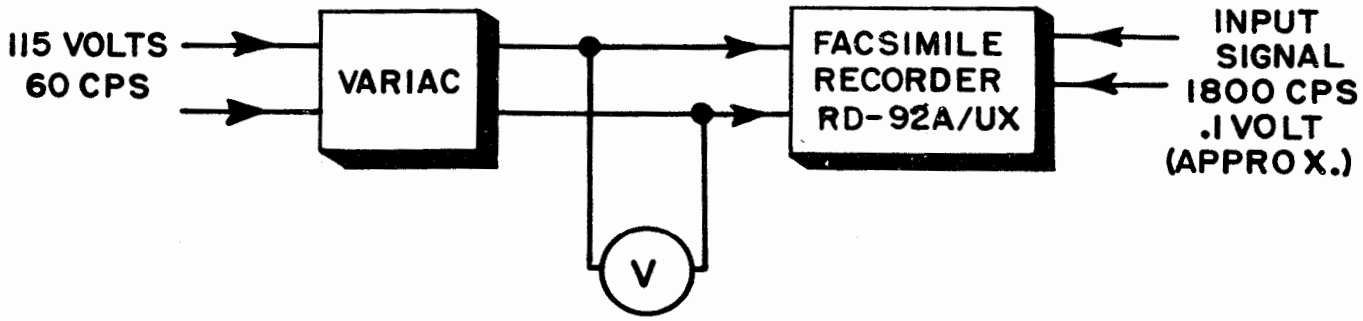


Figure 7–10. Connection Diagram for Selection of CIRCUIT TEST Correction Resistors

cuits. It is satisfactory if the meter test reading is brought as close as possible to 100 with the use of regular resistors. Approximate resistor values for each circuit are given in Table 7–5. If insertion of one of these resistors in its test circuit does not give a meter reading of 100, try a slightly larger or smaller value as indicated in subparagraph (*b*) below. Select the resistor which gives a reading closest to 100, within plus or minus 10. Determine calibrating resistors as follows:

(*a*) SELECTION OF R2. It is first necessary to insert the correct value of R2 in order to have the meter read 100 for the lowest setting of the DENSITY control which will give maximum meter reading. This is necessary, since adjustment of the DENSITY control affects adjustment of other circuits. Proceed as follows:

1. Remove the recorder from cabinet and place it so that the under part of the chassis is accessible.

2. Connect a 6800 ohm, ±10%, ½-watt resistor across the R2 terminals.

3. Connect the test circuit as shown in figure 7–10.

4. Set the Variac to 117-volt a-c output.

5. Following normal operating procedure, turn on the recorder and bring selector switch up to SYNC position.

6. Adjust the DENSITY control for the lowest setting which will give maximum meter reading.

7. If the meter is not 100, within ±10, turn off the recorder and replace R2. If the reading in step *6* is less than 100, try a lower value of R2. If the reading is more than 100, try a larger value of R2.

8. Repeat steps *5, 6,* and *7* until a resistor is installed which gives a meter reading closest to 100 within the required limits.

(*b*) SELECTION OF OTHER CALIBRATING RESISTORS.

1. Check the value of R2 as outlined in subparagraph (*a*) above.

2. Turn off the recorder and insert a resistor of the approximate value listed in Table 7–5 across the terminals for the calibrating resistor being selected.

3. Turn on the Variac and set for 117-volt a-c output.

4. Following normal operating procedure, turn on the recorder up to SYNC position.

5. Adjust the DENSITY control up to the lowest setting which gives maximum meter reading, normally 100.

6. Turn the CIRCUIT TEST switch to the circuit position being tested, and operate the PRESS TO TEST switch.

7. Observe the meter reading. If the reading is not 100, within ±10, turn off the power and replace the resistor under test. If the meter reading is less than 100, try a smaller resistor value; if more than 100, try a larger resistor value.

8. Repeat steps *3, 4, 5, 6,* and *7* until a resistor is installed which gives a meter reading closest to 100 within the required limits.

(*c*) CALIBRATION CHART, TABLE 7–5. Repeat the procedure of subparagraph (*b*) above for all calibrating resistors as indicated in Table 7–5. Note variations in procedure indicated in REMARKS column.

TABLE 7–5. CALIBRATION CHART OF CIRCUIT TEST CIRCUIT

CIRCUIT	CORRECTING RESISTOR	APPROXIMATE RESISTANCE (Ohms)	FIRST CHECK VALUE OF	REMARKS
POWER	R22	20,000	—	No DENSITY control adjustment needed.
SIG AMP OUT	R20	1,000	R2	—
LO B+	R16	20,000	R2	—
HI B+	R14	68,000	R2 and R55	Adjust SYNC MA control so meter reads 100.
OSC	R8	4,700	R2	—
60 ~ MOTOR	R6	15,000	R2	—
VR75	R4	12,000	R2	—
Across Terminals T and C of DENSITY Control	R39	1,000	R2 and R20	1. Remove input signal leads. 2. Turn DENSITY control to TEST SIGNAL position. Meter should read 100.
PRINT	R10	47,000	R2, R20, R55 and R39	1. Adjust SYNC MA reading to 100. 2. Load recording paper. 3. Set DENSITY control to TEST SIGNAL position, selector switch to RUN position, and depress RECORD button. 4. Turn CIRCUIT TEST switch to PRINT position and depress PRESS TO TEST switch.
SYNC DRIVE	R12	2,700	R2 and R55	1. Turn CIRCUIT TEST switch to SYNC MA position and operate PRESS TO TEST switch. 2. Adjust SYNC MA control so that meter reads 100. 3. Turn CIRCUIT TEST switch to SYNC DRIVE position and operate the PRESS TO TEST switch.
SYNC MA	R55	10,000	—	1. Connect a d-c voltmeter across R34. 2. Adjust SNYC MA control so that voltmeter reads 5 volts. 3. Select R55 so that front panel meter reads 100.

(*d*) COMPONENT CHARACTERISTICS.

1. ELECTRON TUBES.—The operating voltages and currents of the electron tubes used in Facsimile Recorder RD–92A/UX are given in Table 7–6. The tube characteristics are listed in Table 7–7.

The voltage readings in Table 7–6 are taken with a 1000-ohms-per-volt meter with the equipment operating in RUN position at 117-volts a-c input power.

2. REPLACEMENT DATA.—Tube checker readings do not necessarily indicate whether or not tubes are defective. Replace tubes in a particular circuit when the CIRCUIT TEST meter reading for that circuit is below 80.

NOTE

ALL TUBES OF A GIVEN TYPE SUPPLIED WITH THE EQUIPMENT SHALL BE CONSUMED PRIOR TO EMPLOYMENT OF TUBES FROM GENERAL STOCK.

3. CRYSTAL RECTIFIER DATA.—Data for the crystal rectifiers are listed in Table 7–8.

TABLE 7–6. TUBE OPERATING VOLTAGES AND CURRENTS

SYMBOL	TUBE TYPE	FUNCTION	PLATE VOLTAGE (V)	PLATE CURRENT (Ma)	SCREEN VOLTAGE (V)	SCREEN CURRENT (Ma)	SUPPRESSOR VOLTAGE (V)	CATHODE VOLTAGE (V)	GRID VOLTAGE (V)	HEATER VOLTAGE (V-ac)
V1A	6SN7	Meter Amplifier	30	0.75	—	—	—	0	−0.4	6.1
V1B[1]		Motor Driver	280	7.5	—	—	—	14	0	6.1
V2[1]	1635	Motor Amplifier	280	25	—	—	—	5	−2.5	6.1
V3[1]	1635	Motor Amplifier	280	25	—	—	—	5	−2.5	6.1
V4[2]	1635	Print Amplifier	280	20	—	—	—	0	−3	6.1
V101A	6SN7	SIG AMP OUT Meter Amplifier	75	0.5	—	—	—	10	1.4	6.1
V101B		3rd Signal Amplifier	100	1.8	—	—	—	3.5	0	6.1
V102A	6SL7	1st Signal Amplifier	25	0.3	—	—	—	0.5	0	6.1
V102B		2nd Signal Amplifier	25	0.3	—	—	—	0.5	0	6.1
V103	6SN7	Detector	—	—	—	—	—	—	—	6.1
V201A	6SN7	Print Driver	300	5	—	—	—	11	0	6.1
V201B		Oscillator (15kc)	28	0.9	—	—	—	0	0	6.1
V202A[3]	6SL7	Modulator	60	0.4	—	—	—	5	0	6.1
V202B		Phase Amplifier	19	0.5	—	—	—	0	0	6.1
V203	2D21	Phase Pulse Amplifier	280	0	—	—	25	25	0	6.1
V301A	6SN7	Fork Pickup Amplifier	13	0.4	—	—	—	0.8	0	6.1
V301B[4]		Fork Drive Amplifier	26	0.5	—	—	—	2.8	—	6.1
V302	6AG7	Fork Limiter Amplifier	37	0.45	10	0.24	0	1	0	6.1

NOTES:

[1] Readings vary with SYNC MA control setting.
[2] Recorder printing in TEST SIGNAL position.
[3] Readings vary with BIAS setting.
[4] Readings vary with fork frequency control (R312) setting.

TABLE 7–7. TUBE CHARACTERISTICS

TUBE TYPE	HEATER VOLTAGE (V-ac)	HEATER CURRENT (Amps)	PLATE VOLTAGE (V)	GRID BIAS (V)	SCREEN VOLTAGE (V)	PLATE CURRENT (Ma)
1635[1]	6.3	0.6	300	0	—	54
2D21	6.3	0.6	—	—	—	—
6AG7	6.3	0.65	300	−10.5	300	25
6SL7	6.3	0.3	250	− 2	—	2.3
6SN7	6.3	0.6	250	− 8	—	9

TUBE TYPE	SCREEN CURRENT (Ma)	AC PLATE RESISTANCE (Ohms)	AMPLIFICATION FACTOR (Mu)	TRANSCONDUCTANCE (Micromhos)		EMISSION	
				Normal	Min	IS Ma	TEST Volt
1635[1]	—	—	—	—	—	100[2]	50
2D21	—	—	—	—	—	—	—
6AG7	6.5	—	—	11,000	9,200	180	20
6SL7	—	44,000	70	1,600	1,200	40[2]	30
6SN7	—	7,700	20	2,600	2,400	40[2]	30

NOTES:
[1] Current rating is for both triodes.
[2] Test each unit separately.

TABLE 7–8. CRYSTAL RECTIFIER DATA

CRYSTAL	FORWARD CURRENT (at −1 volt) (Min. Ma)	MAX. REVERSE CURRENT (at −50 volts) (Ma)	AVERAGE RECTIFIED CURRENT (Ma)	PEAK ANODE CURRENT (Ma)	PEAK INVERSE VOLTAGE (Volts)
1N34A	5.0	0.800	40	150	50
1N48	4.0	0.833	50	150	85

3. COIL WINDING DATA.—Coil winding data is given in Table 7–9.

TABLE 7–9. COIL WINDING DATA

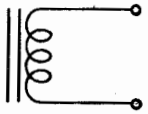
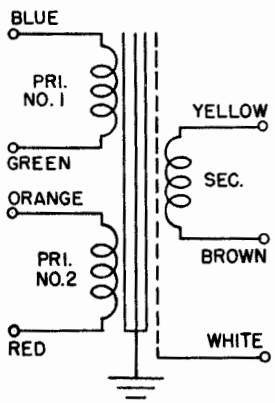
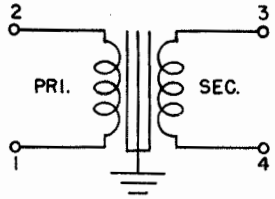
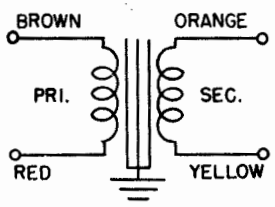
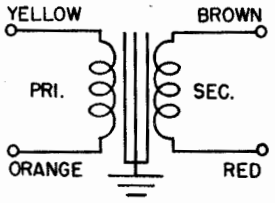
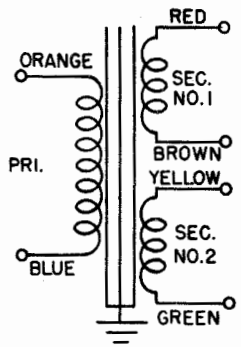
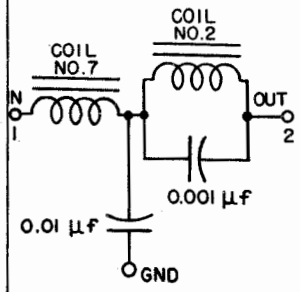
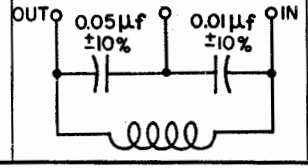
REFERENCE SYMBOL	TIMES FACSIMILE CORP. PART NUMBER	DIAGRAM	WINDING	WIRE SIZE	TURNS	D-C RESISTANCE IN OHMS	IMPEDANCE RATIO (Pri. to Sec.)	TEST VOLTAGE A-C V 60 cps	REMARKS
L201	41B–11–05–00 or 41B–11–05–00–B		Single, random wound	No. 38, formex	3200	270 to 330	—	1000	Inductance: 0.9 to 1.1 henries at 1000 cps Q: 1 minimum.
T1	41B–11–06–00–V		Pri. No. 1, random wound Pri. No. 2, random wound Shield Sec., random wound	No. 41 heavy formex No. 41 heavy formex No. 41 heavy formex No. 41 heavy formex	390 390 1 layer 3900	100 max. 100 max. — 1200 max.	1:100 1:100 — —	1000	YEL, BLU, and RED terminals connect to start of windings.
T2	41B–11–02–00–V		Pri., layer wound Sec., layer wound	No. 36 formex No. 36 formex	1000 1800	120 max. 270 max.	1:3.25	3000	Terminals #1 and #3 are connected to start of windings.
T3	41B–11–01–00–V		Pri., random wound Sec., random wound	No. 34 heavy formex No. 34 heavy formex	1200 480	60 max. 30 max.	6.25:1	1000	BRN and ORG terminals connect to start of windings.
T4	41B–11–03–00–V		Pri., random wound Sec., random wound	No. 41 heavy formex No. 41 heavy formex	5500 1500	1600 max. 330 max.	13:1	1000	BRN and ORG terminals connect to start of winding.

TABLE 7–9. COIL WINDING DATA (Continued)

REFERENCE SYMBOL	TIMES FACSIMILE CORP. PART NUMBER	DIAGRAM	WINDING	WIRE SIZE	TURNS	D-C RESISTANCE IN OHMS	IMPEDANCE RATIO (Pri. to Sec.)	TEST VOLTAGE A-C V 60 cps	REMARKS
T101	41B–11–00–00–V		Pri., random wound	No. 41 heavy formex	3300	1200 max.	—	1000	BLU, BRN, and GRN terminals connect to start of windings.
			Sec. No. 1, random wound	No. 41 heavy formex	1900	500 max.	3:1		
			Sec. No. 2, random wound	No. 41 heavy formex	1900	650 max.	3:1		
Z1	41B–11–07–00–V		Coil No. 1, random wound	No. 40 formex	4300	630 to 770	—	1000	Inductance: 3.1 to 3.5 henries at 1000 cps Q: 10 minimum.
			Coil No. 2, random wound	No. 40 formex	4300	630 to 770	—		Inductance: adjust for parallel with 0.001 mf at 2600 ±50 cps Q of coil — 8 minimum.
Z201	41B–11–04–00 or 41B–11–04–00–B		Random wound	No. 36 formex	2150	120 to 140	—	1000	Parallel resonance occurs between 14 and 18 kc across IN and OUT terminals.

5. ATTENUATION CHARACTERISTICS.—The attenuation characteristics of low pass filter Z1 and noise suppressor filter Z2 are shown in the curves of figures 7–11 and 7–12, respectively.

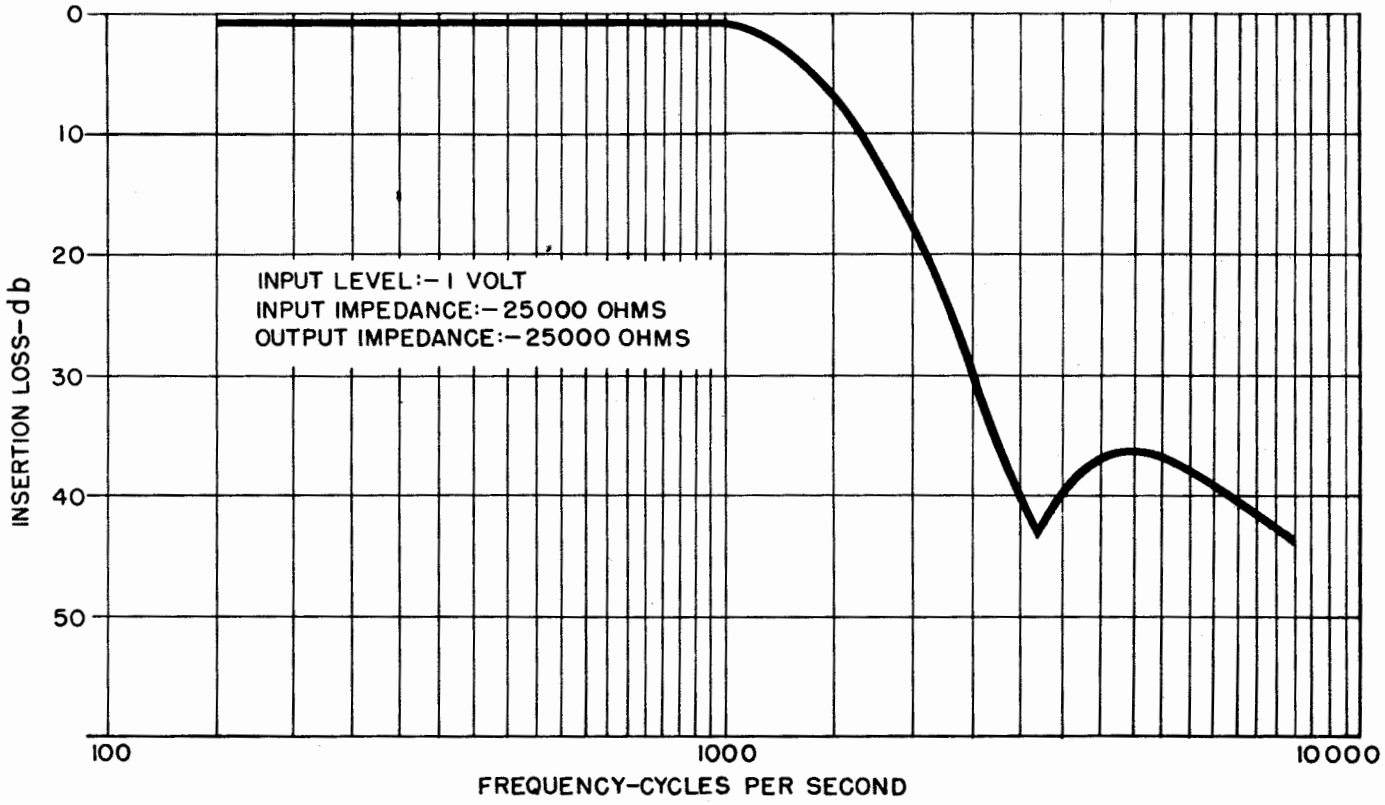


Figure 7–11. Attenuation Characteristics—Low Pass Filter Z1

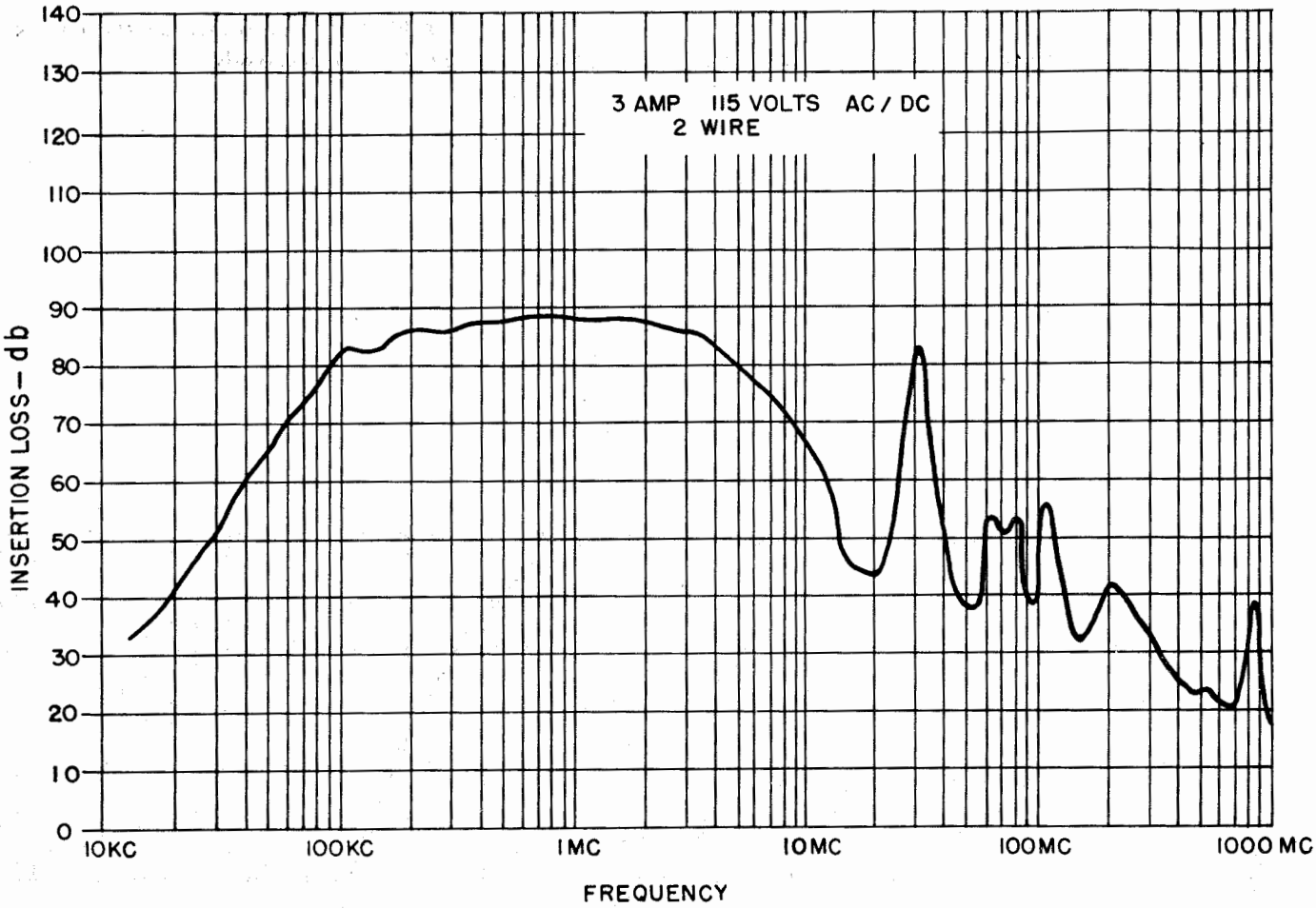


Figure 7-12. Attenuation Characteristics—Noise Suppression Filter Z2

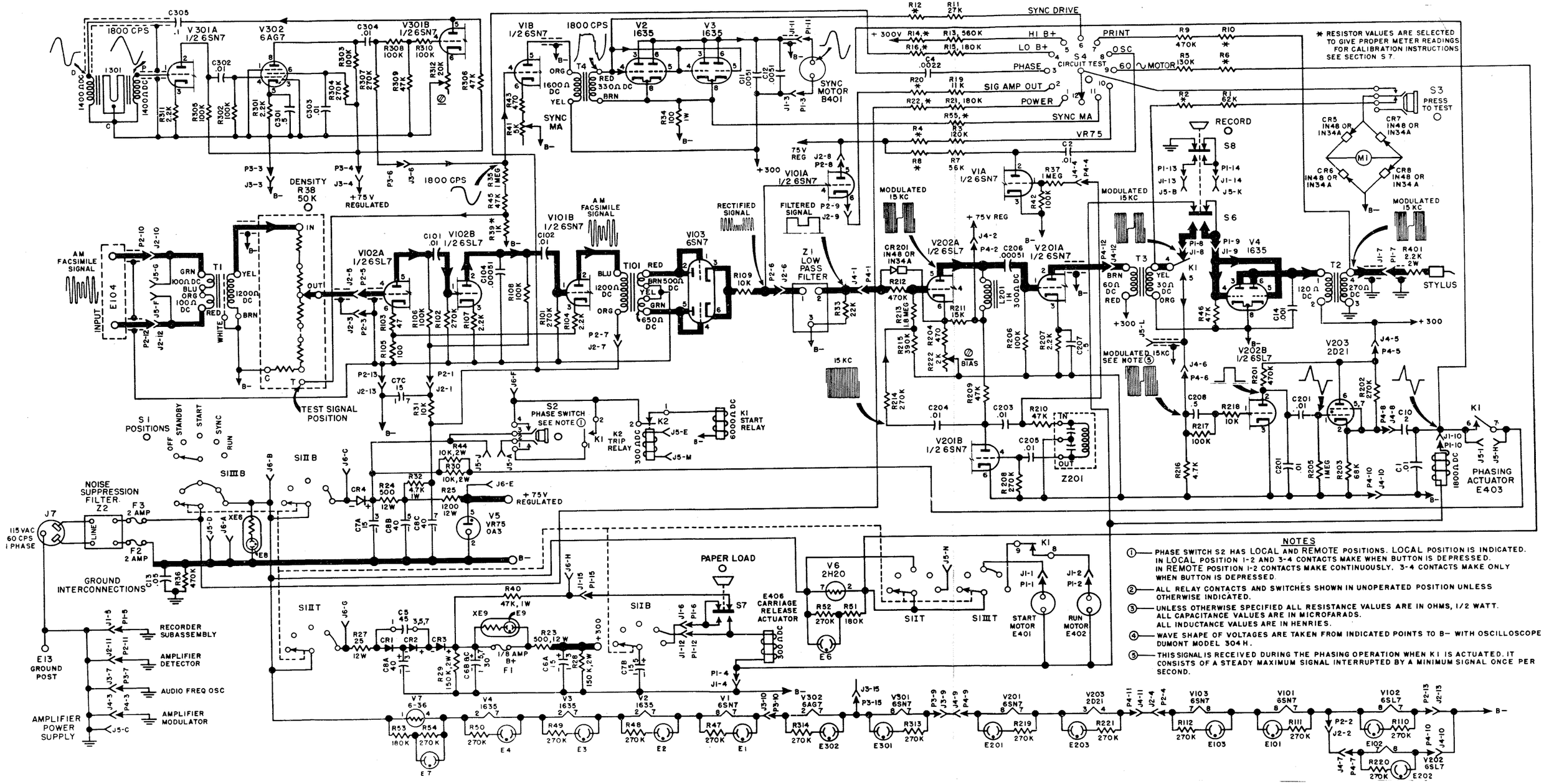
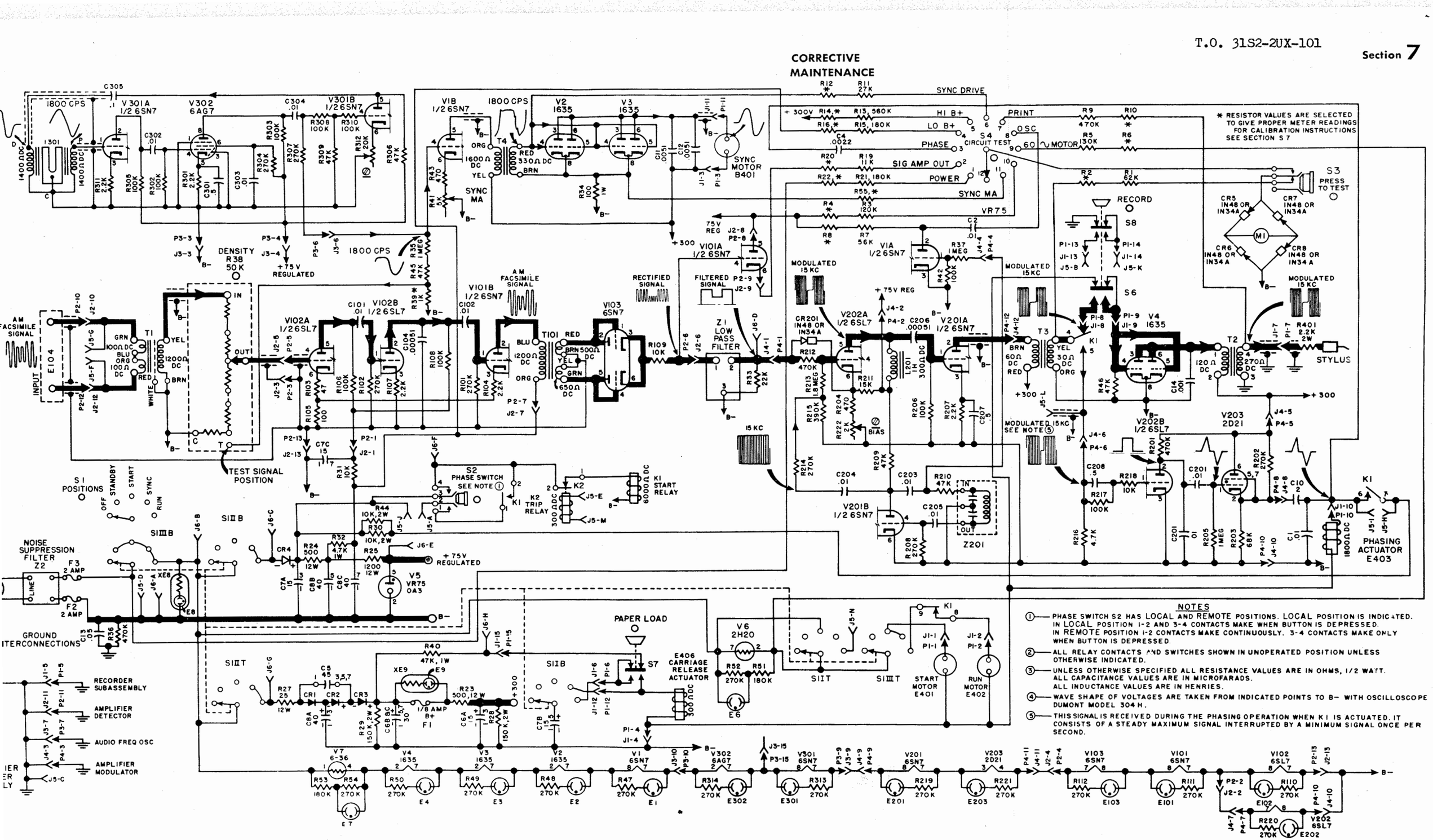


Figure 7–13. Over-all Schematic Diagram of Facsimile Recorder RD–92A/UX



NOTES

(1) PHASE SWITCH S2 HAS LOCAL AND REMOTE POSITIONS. LOCAL POSITION IS INDICATED. IN LOCAL POSITION 1-2 AND 3-4 CONTACTS MAKE WHEN BUTTON IS DEPRESSED. IN REMOTE POSITION 1-2 CONTACTS MAKE CONTINUOUSLY. 3-4 CONTACTS MAKE ONLY WHEN BUTTON IS DEPRESSED.

(2) ALL RELAY CONTACTS AND SWITCHES SHOWN IN UNOPERATED POSITION UNLESS OTHERWISE INDICATED.

(3) UNLESS OTHERWISE SPECIFIED ALL RESISTANCE VALUES ARE IN OHMS, 1/2 WATT. ALL CAPACITANCE VALUES ARE IN MICROFARADS. ALL INDUCTANCE VALUES ARE IN HENRIES.

(4) WAVE SHAPE OF VOLTAGES ARE TAKEN FROM INDICATED POINTS TO B- WITH OSCILLOSCOPE DUMONT MODEL 304 H.

(5) THIS SIGNAL IS RECEIVED DURING THE PHASING OPERATION WHEN K1 IS ACTUATED. IT CONSISTS OF A STEADY MAXIMUM SIGNAL INTERRUPTED BY A MINIMUM SIGNAL ONCE PER SECOND.

Figure 7–13. Over-all Schematic Diagram of Facsimile Recorder RD–92A/UX

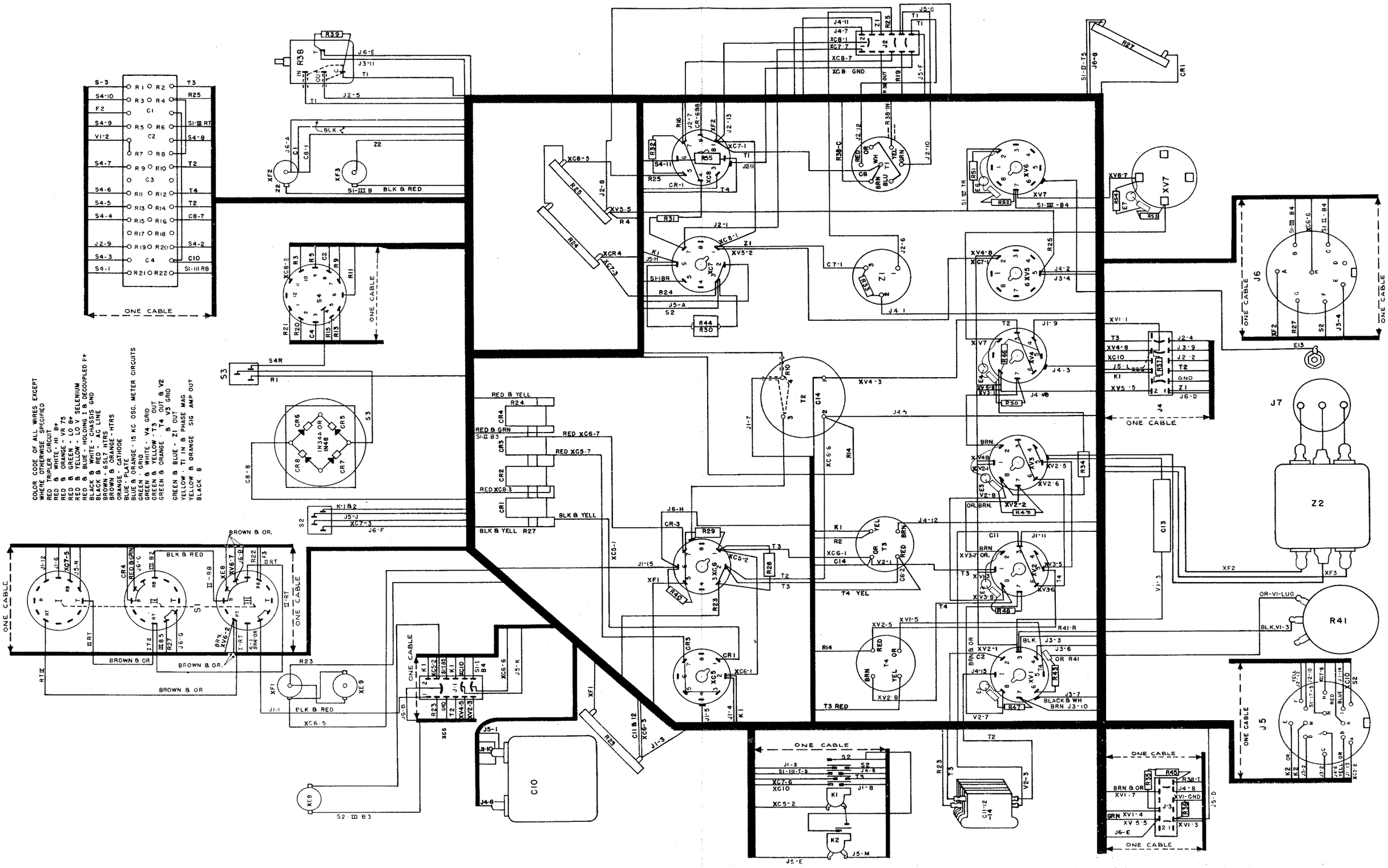


Figure 7–14. Location of Parts and Wiring Diagram of Amplifier-Power Supply Chasis

PARTS IDENTIFICATION FOR FIGURE 7–15

INDEX NO.	REF DESIG	NAME	INDEX NO.	REF DESIG	NAME
1	p/o U4	Knob	30		Screw
2		Screw	31		Washer, lock
3		Screw	32	0478	Shaft
4	p/o U4	Plate and drum shield ass'y	33		Nut
			34	p/o U4	LH cover ass'y
5	0474	Holder	35		Screw
6	0471	Brush, bristle	36		Washer, lock
7	p/o U4	RH end cover ass'y	37	p/o U4	LH gear box ass'y
8		Screw	38		Screw
9		Screw	39		Washer, lock
10		Washer, lock	40	p/o U4	Drum shield ass'y
11	0417	Spring	41		Screw
12		Screw	42		Washer, lock
13		Washer, lock	43	E409	Terminal board
14	p/o U4	RH end cover	44		Screw
15	0487	Shaft	45		Washer, lock
16	0476	Drum, facsimile	46	p/o U4	Plate
17	0467	Cam	47		Screw
18	0454	Retainer, mechanical	48	P1	Insert, electrical connector
19	0429	Gear			
20	p/o U4	Gear	49		Screw
21	0444	Retainer, mechanical	50		Nut
22	0410	Bearing, ball	51		Washer, lock
23	p/o U4	RH gear box	52	p/o U4	Clamp
24		Screw	53		Screw
25		Screw	54		Washer, lock
26	0465	Shaft ass'y	55	p/o U4	Base channel
27	p/o U4	Stylus carriage ass'y	56		Screw
28	0476	Shaft ass'y	57		Spacer
29	p/o U4	Top cover and return spring ass'y			

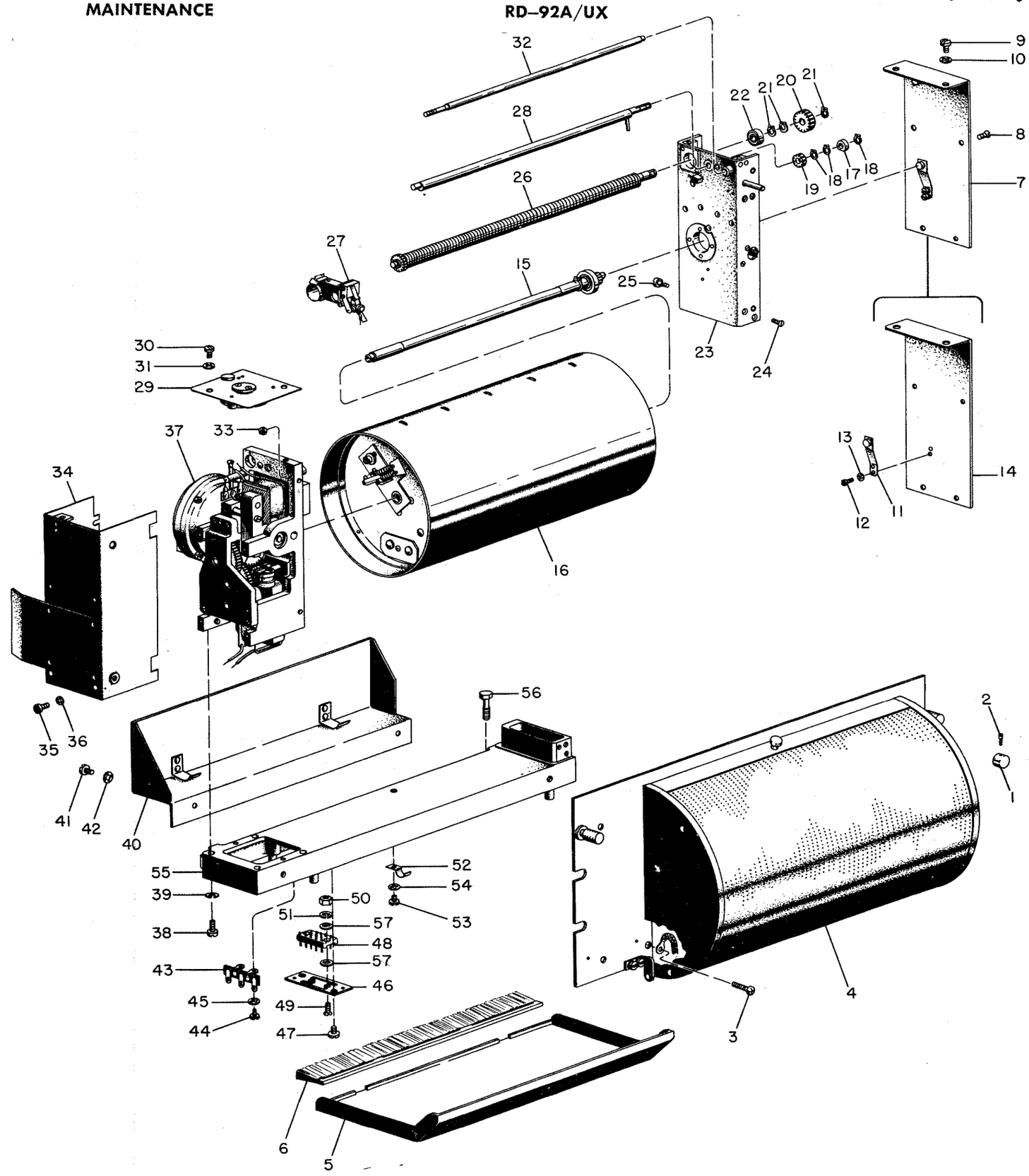


Figure 7–15. Exploded View of Main Mechanical Assembly

PARTS IDENTIFICATION FOR FIGURE 7–15

INDEX NO.	REF DESIG	NAME	INDEX NO.	REF DESIG	NAME
1	p/o U4	Knob	30		Screw
2		Screw	31		Washer, lock
3		Screw	32	0478	Shaft
4	p/o U4	Plate and drum shield ass'y	33		Nut
			34	p/o U4	LH cover ass'y
5	0474	Holder	35		Screw
6	0471	Brush, bristle	36		Washer, lock
7	p/o U4	RH end cover ass'y	37	p/o U4	LH gear box ass'y
8		Screw	38		Screw
9		Screw	39		Washer, lock
10		Washer, lock	40	p/o U4	Drum shield ass'y
11	0417	Spring	41		Screw
12		Screw	42		Washer, lock
13		Washer, lock	43	E409	Terminal board
14	p/o U4	RH end cover	44		Screw
15	0487	Shaft	45		Washer, lock
16	0476	Drum, facsimile	46	p/o U4	Plate
17	0467	Cam	47		Screw
18	0454	Retainer, mechanical	48	P1	Insert, electrical connector
19	0429	Gear			
20	p/o U4	Gear	49		Screw
21	0444	Retainer, mechanical	50		Nut
22	0410	Bearing, ball	51		Washer, lock
23	p/o U4	RH gear box	52	p/o U4	Clamp
24		Screw	53		Screw
25		Screw	54		Washer, lock
26	0465	Shaft ass'y	55	p/o U4	Base channel
27	p/o U4	Stylus carriage ass'y	56		Screw
28	0473	Shaft ass'y	57		Spacer
29	p/o U4	Top cover and return spring ass'y			

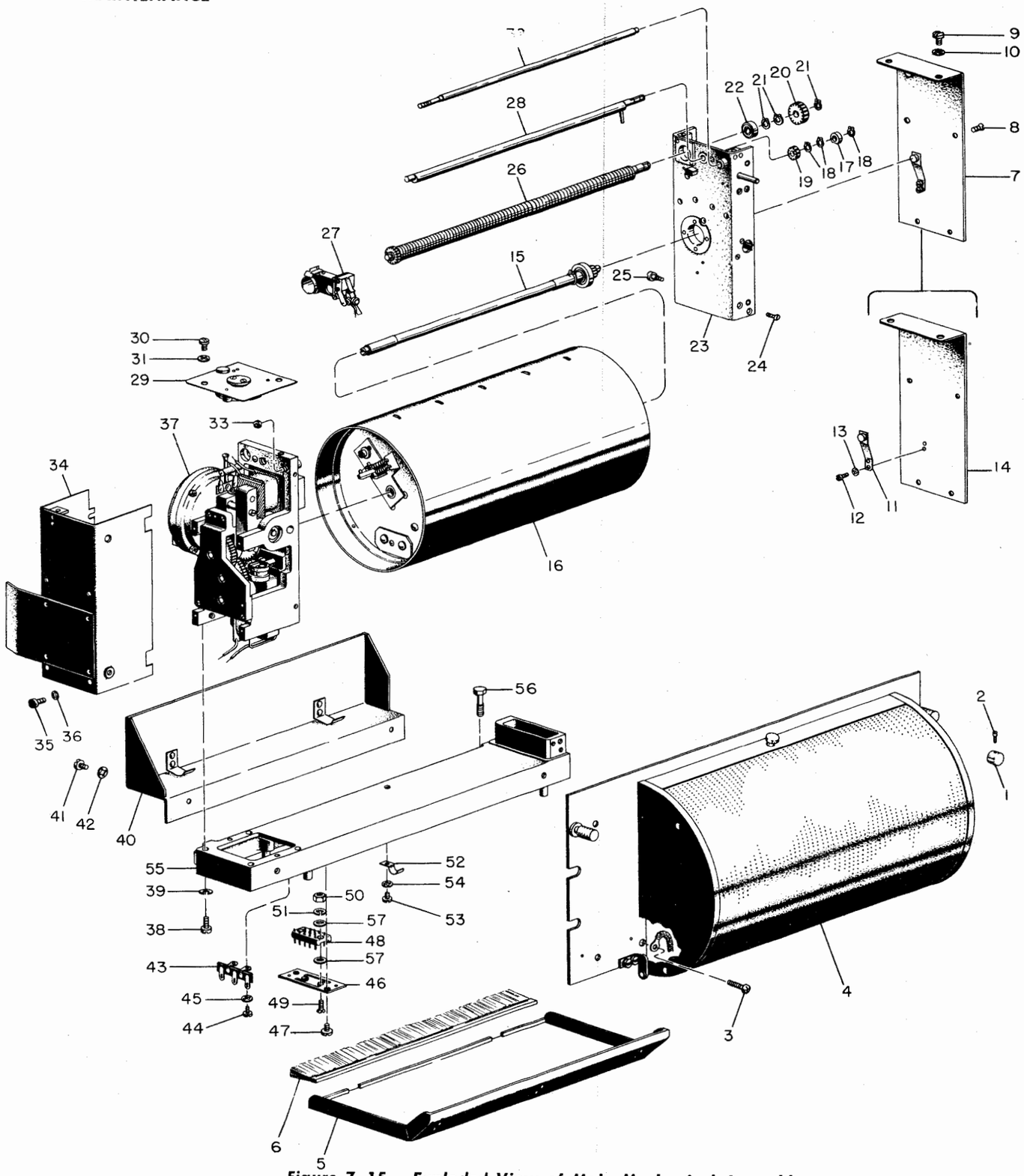


Figure 7–15. Exploded View of Main Mechanical Assembly

PARTS IDENTIFICATION FOR FIGURE 7–16

INDEX NO.	REF DESIG	NAME	INDEX NO.	REF DESIG	NAME
1	0490	Shield, drum	7		Screw
2		Screw	8	0488	Spring
3		Washer, lock	9		Screw
4	0489	Chain	10		Washer, lock
5	0475	Guide, paper	11	0477	Plate, cover
6	0491	Holder, chain			

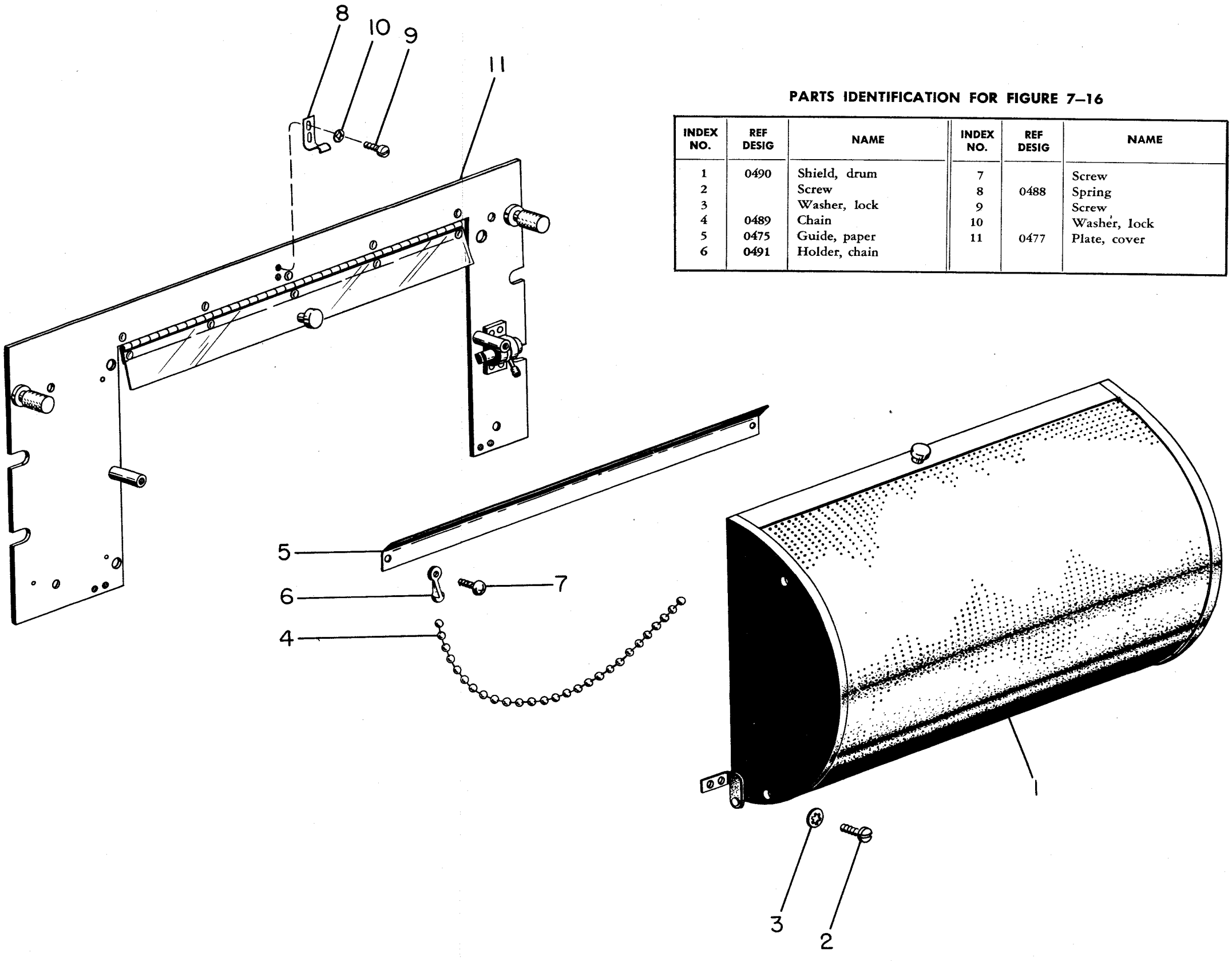
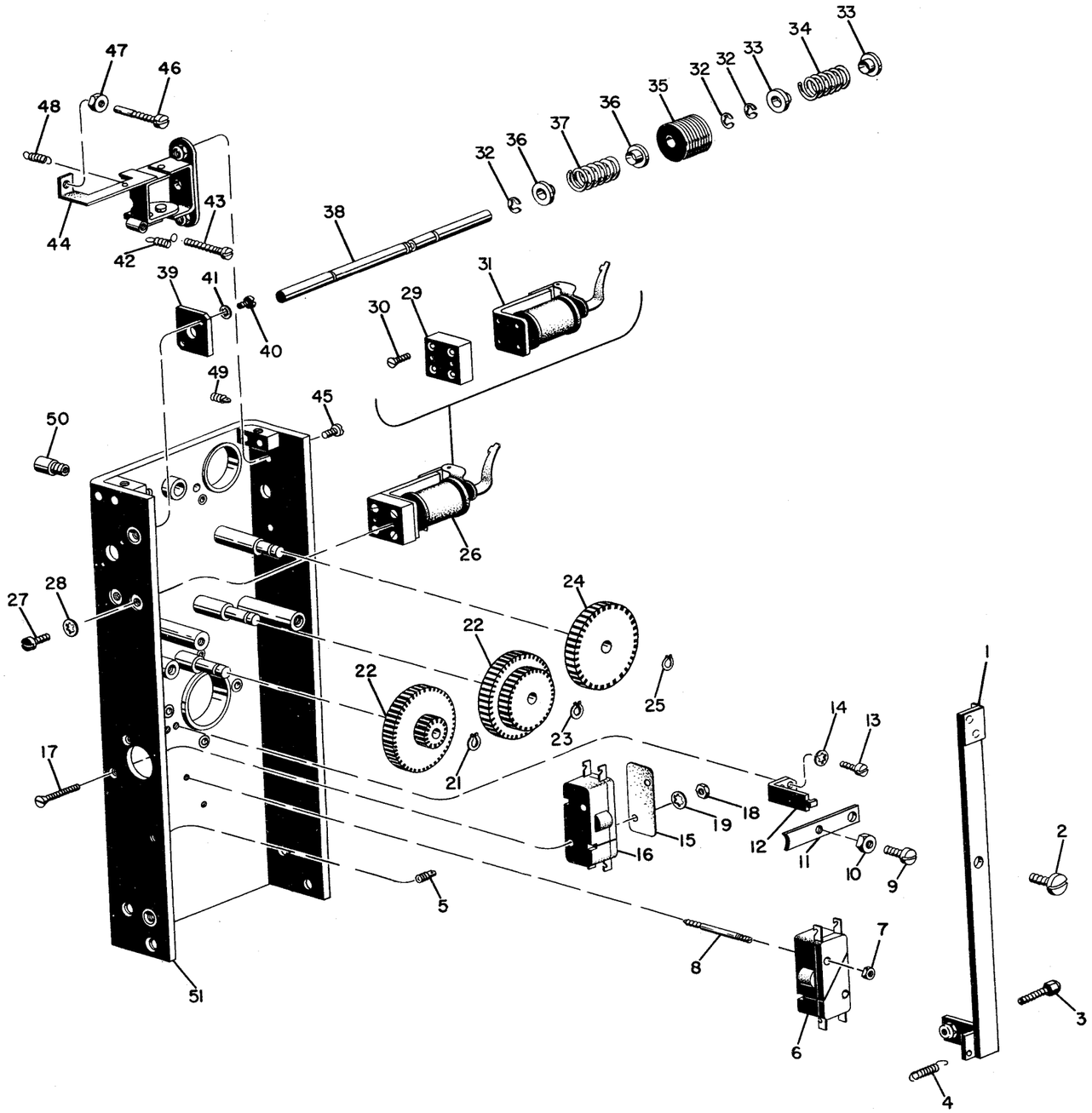


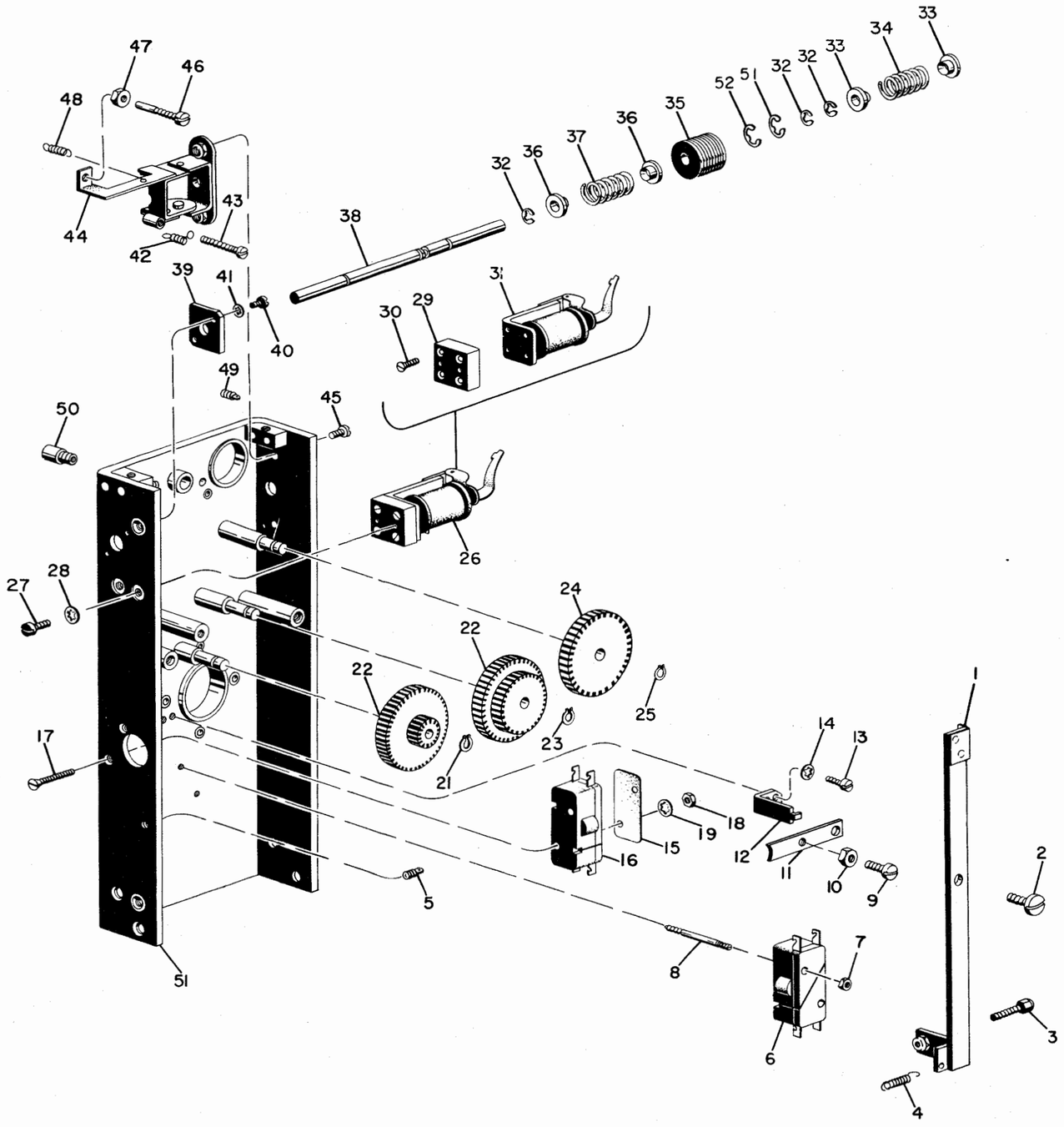
Figure 7–16. Exploded View of Upper Front Panel Assembly



PARTS IDENTIFICATION FOR FIGURE 7–17

INDEX NO.	REF DESIG	NAME	INDEX NO.	REF DESIG	NAME
1	p/o U4	Switch lever assembly	26	E406	Electromagnetic actuator
2		Screw			Screw
3		Screw	27		Washer, lock
4	0419	Spring	28		Base
5	p/o U4	Post, spring	29	p/o E406	Screw
6	S6	Switch, sensitive	30		Magnet
7		Nut	31	p/o E406	Retainer, Mechanical
8	p/o U4	Stud	32	0438	Spring, locator
9		Screw	33	p/o U4	Spring
10		Nut	34	0423	Gear, circular rack
11	p/o U4	Lever	35	0430	Spring, locator
12	p/o U4	Bracket	36	p/o U4	Spring
13		Screw	37	0426	Shaft
14		Washer, lock	38	p/o U4	Plate
15	p/o U4	Plate	39	p/o U4	Screw
16	S7	Switch, sensitive	40		Washer, lock
17		Screw	41		Spring
18		Nut	42	0422	Screw
19		Washer, lock	43		Latch ass'y
20	0434	Gear	44	p/o U4	Screw
21	0453	Retainer, mechanical	45		Pin
22	0435	Gear	46	p/o U4	Nut
23	0451	Retainer, Mechanical	47		Spring
24	0436	Gear	48	0421	Spring post
25	0452	Retainer, Mechanical	49	p/o U4	Insulator
			50	p/o U4	

Figure 7–17. Exploded View of Right-hand Gear Box

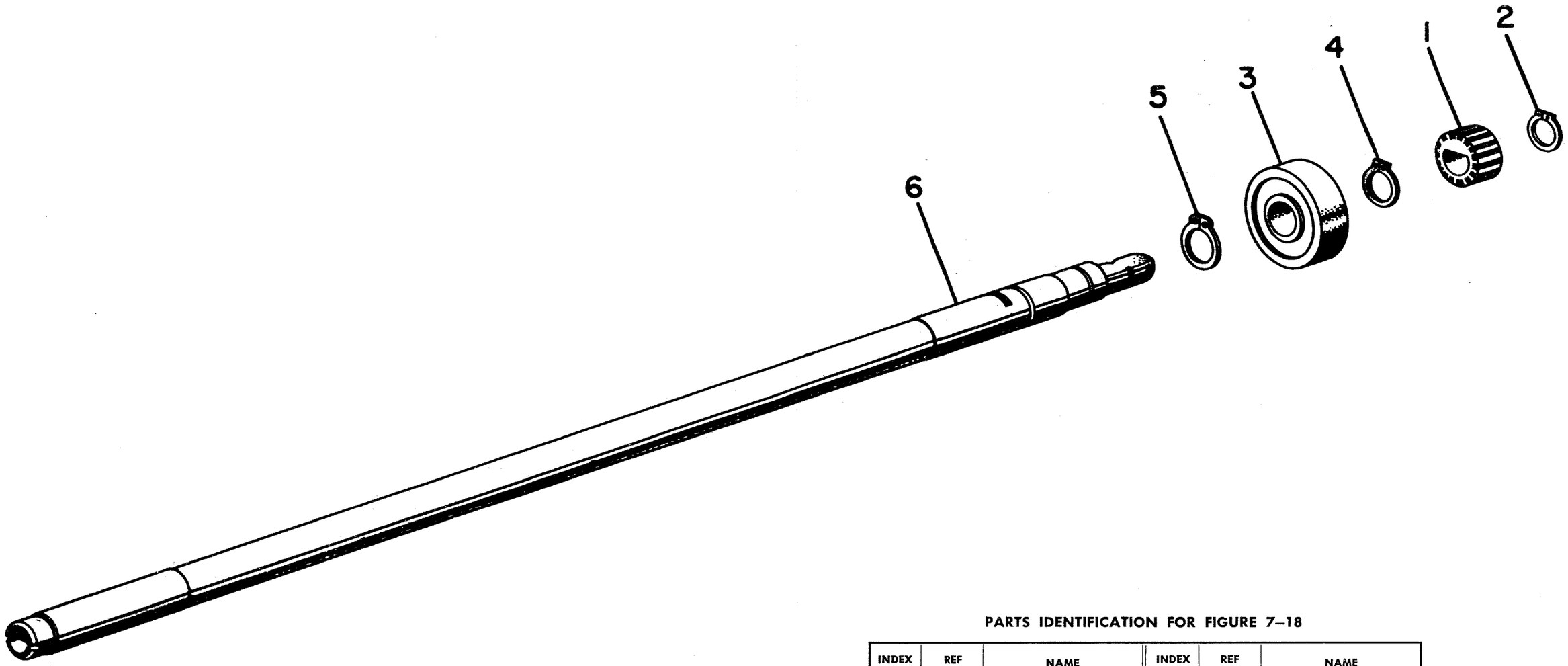


PARTS IDENTIFICATION FOR FIGURE 7–17

INDEX NO.	REF DESIG	NAME	INDEX NO.	REF DESIG	NAME
1	p/o U4	Switch lever assembly	27		Screw
2		Screw	28		Washer, lock
3		Screw	29	p/o E406	Base
4	0419	Spring	30		Screw
5	p/o U4	Post, spring	31	p/o E406	Magnet
6	S6	Switch, sensitive	32	0438	Retainer, Mechanical
7		Nut	33	p/o U4	Spring, locator
8	p/o U4	Stud	34	0423	Spring
9		Screw	35	0430	Gear, circular rack
10		Nut	36	p/o U4	Spring, locator
11	p/o U4	Lever	37	0426	Spring
12	p/o U4	Bracket	38	p/o U4	Shaft
13		Screw	39	p/o U4	Plate
14		Washer, lock	40		Screw
15	p/o U4	Plate	41		Washer, lock
16	S7	Switch, sensitive	42	0422	Spring
17		Screw	43		Screw
18		Nut	44	p/o U4	Latch ass'y
19		Washer, lock	45		Screw
20	0434	Gear	46	p/o U4	Pin
21	0453	Retainer, mechanical	47		Nut
22	0435	Gear	48	0421	Spring
23	0451	Retainer, Mechanical	49	p/o U4	Spring post
24	0436	Gear	50	p/o U4	Insulator
25	0452	Retainer, Mechanical	*51	0496	Retainer, ring
26	E406	Electromagnetic actuator	*52	0497	Retainer, ring

*On RD-92A/UX, serial no. 338 and higher

Figure 7–17. Exploded View of Right-hand Gear Box



PARTS IDENTIFICATION FOR FIGURE 7–18

INDEX NO.	REF DESIG	NAME	INDEX NO.	REF DESIG	NAME
1	0428	Gear	4	0441	Retainer, mechanical
2	0442	Retainer, mechanical	5	0458	Retainer, mechanical
3	0416	Bearing, ball	6	0487	Shaft

Figure 7–18. Exploded View of Drum Shaft Assembly

PARTS IDENTIFICATION FOR FIGURE 7–19

INDEX NO.	REF DESIG	NAME	INDEX NO.	REF DESIG	NAME
1	p/o U4	Bearing plate assembly	43	p/o U4	Spacer
2		Screw	44	B401	Motor, self synchronous
3		Washer, lock	45	p/o U4	Oil duct assembly
4	0406	Bearing, ball	46		Screw
5	0449	Retainer, mechanical	47		Washer, lock
6	p/o 0433	Rotor	48	R401	Resistor, fixed composition
7	0450	Retainer, mechanical			
8	0407	Bearing, ball	49	E408	Terminal board
9	0404	Bearing, ball	50		Screw
10	0447	Retainer, mechanical	51		Washer, lock
11	0431	Shaft assembly	52	E401	Winding, motor field
12	0405	Bearing, ball	53		Screw
13	p/o U4	Shaft	54		Washer, lock
14	p/o U4	Pin	55	p/o U4	Spacers
15	H406	Washer, flat	56		Screw
16	p/o U4	Gear	57		Washer, lock
17	0408	Bearing, ball	58		Spacer
18	0402	Bearing, ball	59	p/o U4	Cover
19		Screw	60		Screw
20		Washer, lock	61		Washer, lock
21	p/o U4	Bearing, plate	62	E403	Electromagnetic actuator
22	H409	Washer, flat			
23	p/o U4	Spacer	63		Screw
24	0437	Gear, worm	64		Washer, lock
25	p/o U4	Clamp	65	p/o U4	Spacer
26		Screw	66	p/o E403	Armature
27		Washer, lock	67	p/o E403	Spring
28	0403	Bearing, ball	68		Screw
29	0415	Bearing, ball	69		Nut
30	0464	Drive subassembly	70		Washer, lock
31	H418	Nut, plain, round	71	p/o E403	Coil and field assembly
32	p/o 0464	Stop bar	72		Screw
33		Screw	73		Nut
34		Washer, lock	74	p/o U4	Holder for 0426
35	p/o 0464	Sync drive assembly	75	0426	Spring
36	p/o U4	Shaft	76		Screw
37	E402	Winding, motor field	77		Nut
38		Screw	78	0459	Bumper
39		Washer, lock	79		Screw
40	p/o U4	Clamp	80	p/o U4	Insulator
41		Screw	81	p/o U4	Grommet
42		Washer, lock	82	p/o U4	Gear box casting

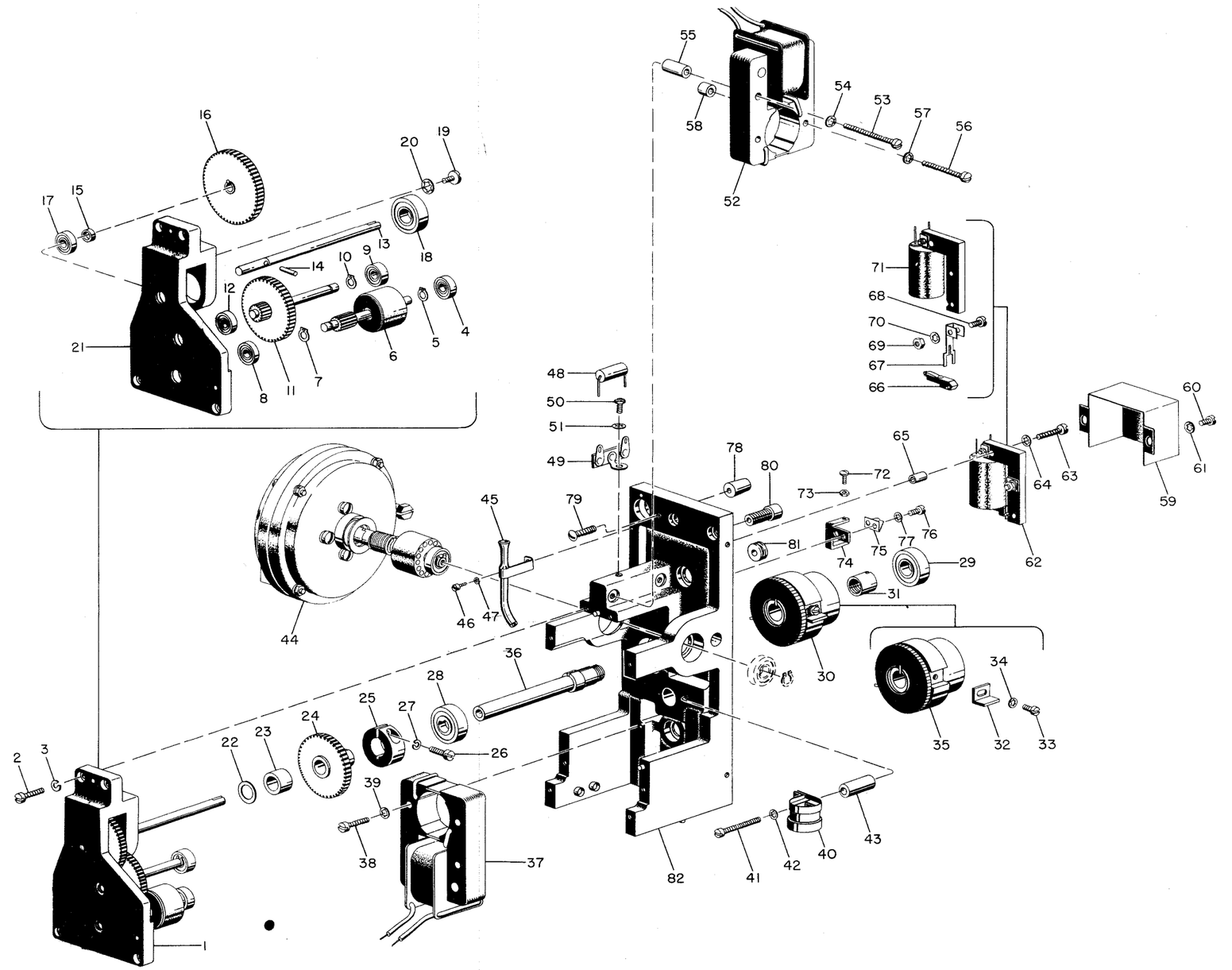
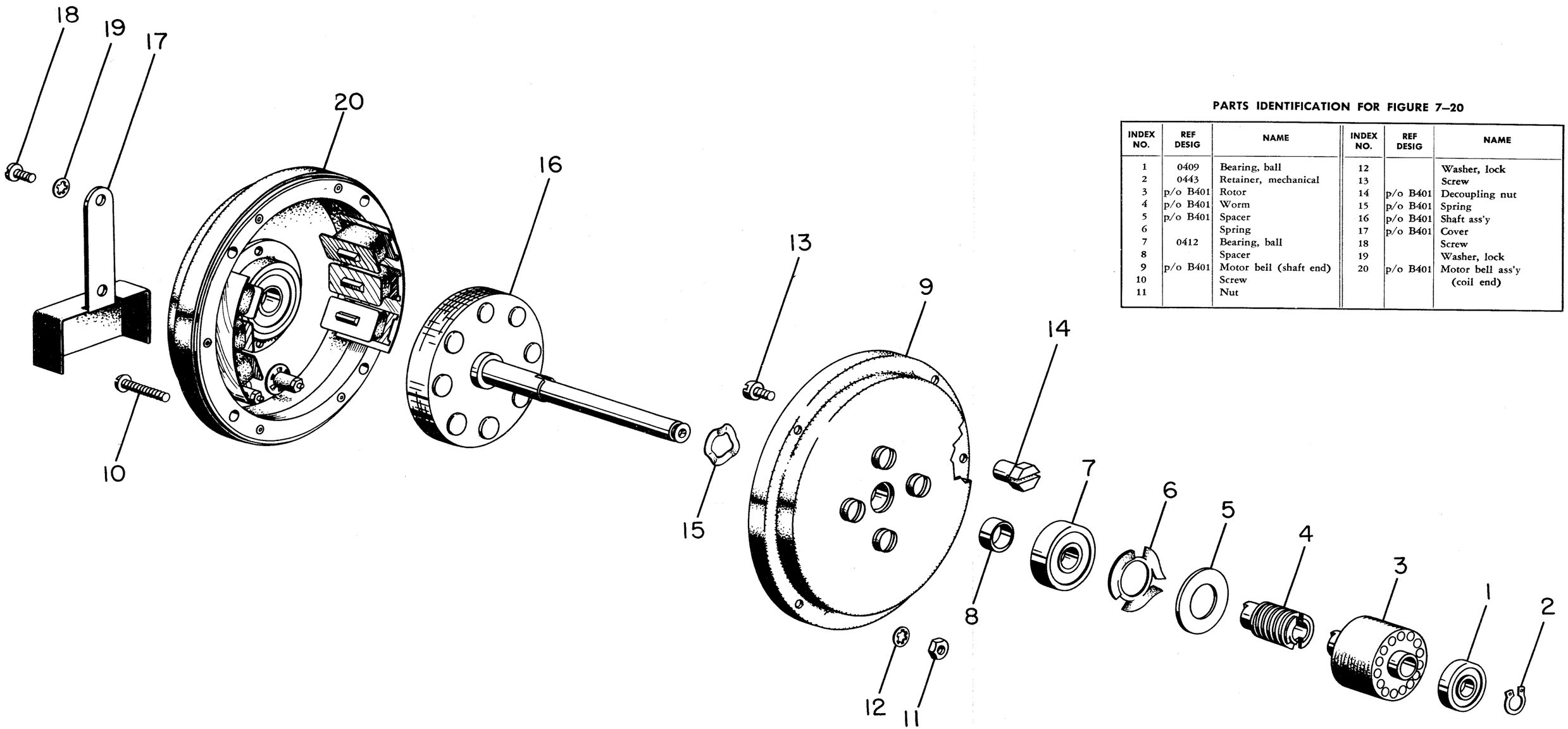


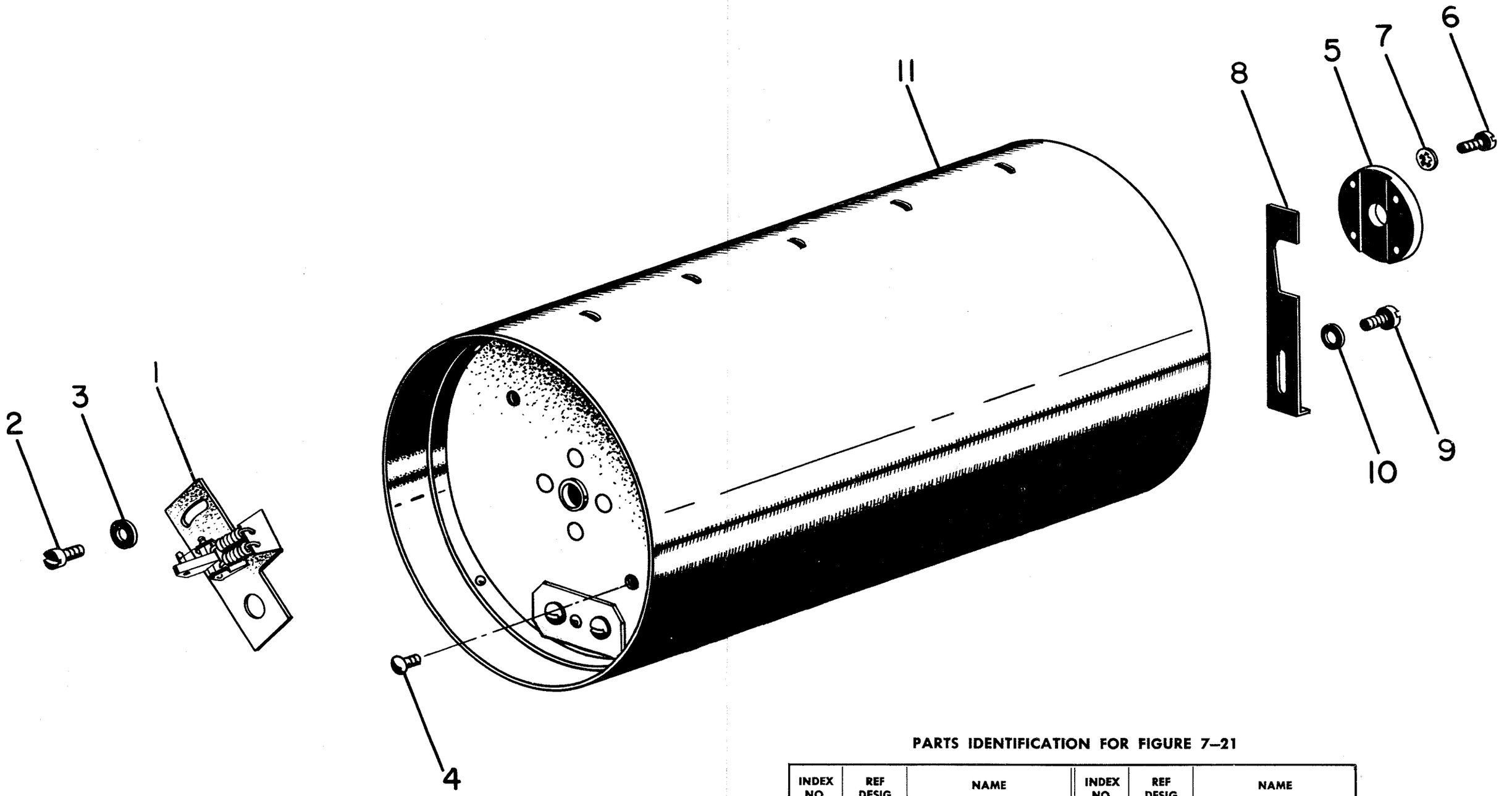
Figure 7–19. Exploded View of Left-hand Gear Box



PARTS IDENTIFICATION FOR FIGURE 7–20

INDEX NO.	REF DESIG	NAME	INDEX NO.	REF DESIG	NAME
1	0409	Bearing, ball	12		Washer, lock
2	0443	Retainer, mechanical	13		Screw
3	p/o B401	Rotor	14	p/o B401	Decoupling nut
4	p/o B401	Worm	15	p/o B401	Spring
5	p/o B401	Spacer	16	p/o B401	Shaft ass'y
6		Spring	17	p/o B401	Cover
7	0412	Bearing, ball	18		Screw
8		Spacer	19		Washer, lock
9	p/o B401	Motor bell (shaft end)	20	p/o B401	Motor bell ass'y (coil end)
10		Screw			
11		Nut			

Figure 7–20. Exploded View of Synchronous Motor Assembly



PARTS IDENTIFICATION FOR FIGURE 7–21

INDEX NO.	REF DESIG	NAME	INDEX NO.	REF DESIG	NAME
1	0463	Coupling section	7		Washer, lock
2		Screw	8	p/o 0476	Slide plate
3		Washer, plain	9		Screw
4		Screw	10		Washer, plain
5	p/o 0476	Bearing, hub	11	p/o 0476	Drum
6		Screw			

Figure 7–21. Exploded View of Drum Assembly

PARTS IDENTIFICATION FOR FIGURE 7–22

INDEX NO.	REF DESIG	NAME	INDEX NO.	REF DESIG	NAME
1	p/o U4	Pivot ass'y	7	0420	Spring
2		Screw	8		Spacer
3		Nut	9	p/o U4	Pivot plate
4		Washer, lock	10		Screw
5	p/o U4	Hook	11		Screw
6	MS401	String	12	p/o U4	Cover ass'y

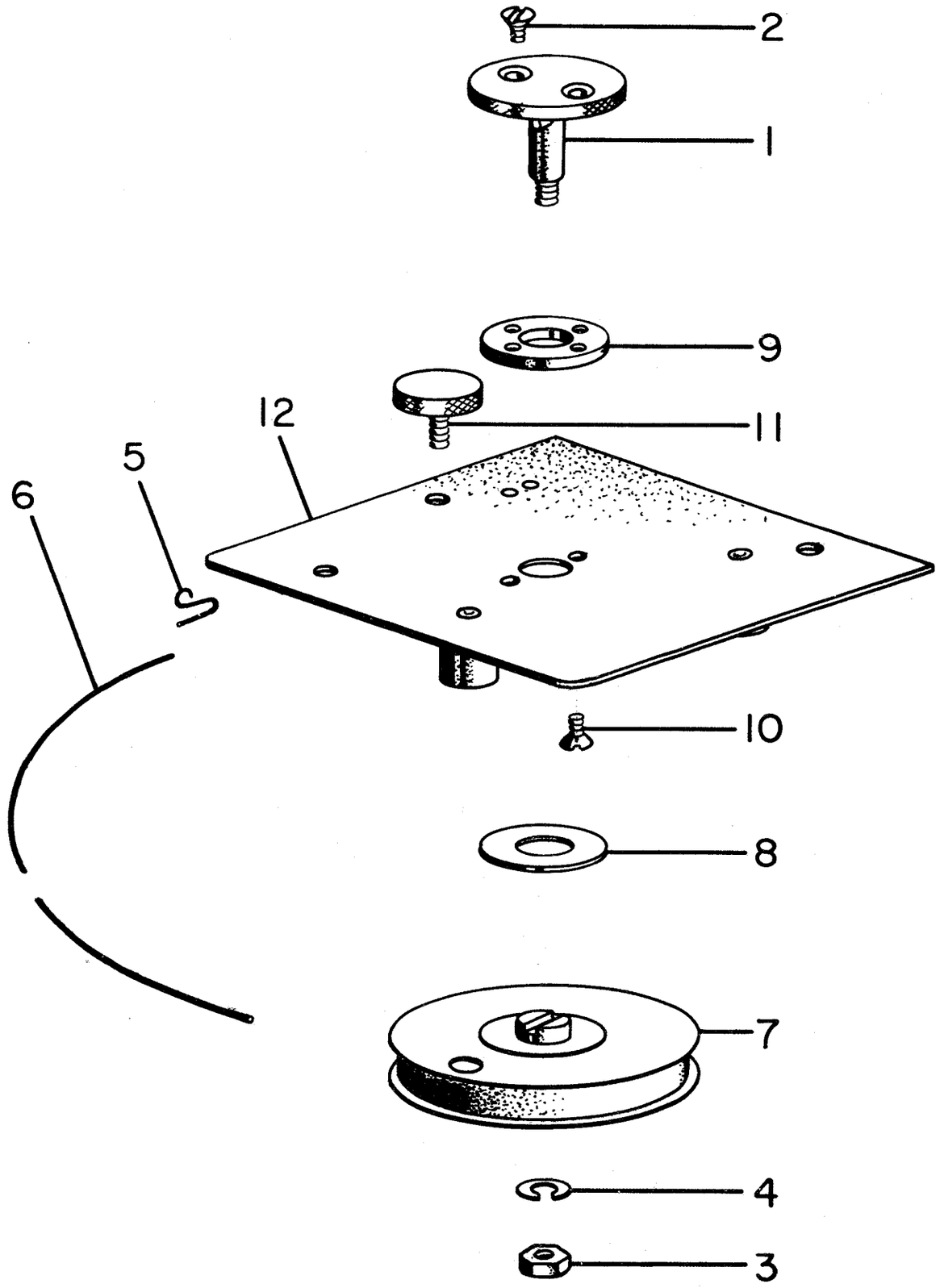


Figure 7–22. Exploded View of Return Spring and Top Cover Assembiy

PARTS IDENTIFICATION FOR FIGURE 7–23

INDEX NO.	REF DESIG	NAME	INDEX NO.	REF DESIG	NAME
1	p/o U4	Cover	16	0401	Stylus, recording, electric
2		Screw			
3		Washer, lock	17	p/o U4	Block ass'y
4	p/o U4	Insulator	18	p/o U4	Contact spring
5		Screw	19	p/o U4	Cover
6	0468	Nut, half	20	p/o U4	Spring
7	p/o U4	Holder ass'y	21	p/o U4	Left hand plate
8		Screw	22	0460	Holder, stylus
9		Washer, lock	23	0425	Spring
10	p/o U4	Bracket	24	p/o U4	Right hand plate
11		Screw	25		Screw
12		Washer, lock	26		Nut
13	0462	Guide, paper	27		Washer, lock
14		Screw	28	p/o U4	Block
15	p/o U4	Holder	29	0461	Carriage subassembly

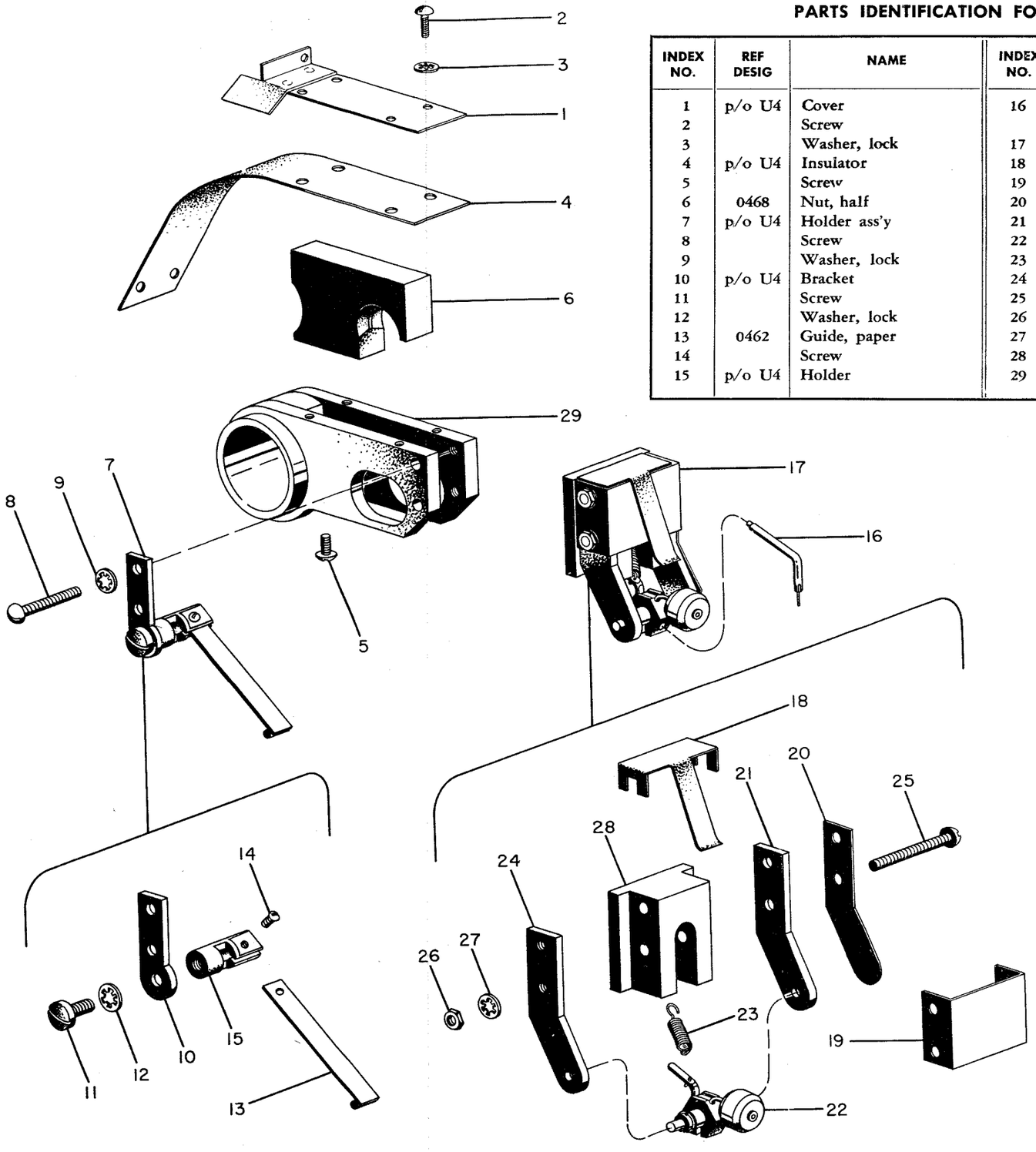


Figure 7–23. Exploded View of Stylus and Carriage Assembly

TABLE 8–1. WEIGHTS AND DIMENSIONS OF SPARE PARTS BOXES

EQUIPMENT SPARES					
SPARE PARTS BOX	OVERALL DIMENSIONS			VOLUME	WEIGHT
	HEIGHT	WIDTH	DEPTH		
1	12 in.	9 in.	6 in.	648 cu. in.	30 lbs.

TABLE 8–2. SHIPPING WEIGHTS AND DIMENSIONS OF SPARE PARTS BOXES

EQUIPMENT SPARES						
SHIPPING BOX NUMBER	SPARE PARTS BOX	OVERALL DIMENSIONS			VOLUME	WEIGHT
		HEIGHT	WIDTH	DEPTH		
1	1	16 in.	10½ in.	7½ in.	1260 cu. in.	40 lbs.

TABLE 8–3. LIST OF MAJOR UNITS

SYMBOL GROUP	QUANTITY				NAME OF MAJOR UNIT	NAVY TYPE DESIGNATION
	115 V. A. C.	230 V. A. C.	220/ 3/60	440/ 3/60		
1-499	1				FACSIMILE RECORDER	RD-92A/UX

TABLE 8-4. TABLE OF REPLACEABLE PARTS

REF. DESIG.	STOCK NUMBER: SIGNAL CORPS, STANDARD NAVY, AIR FORCE	NAME AND DESCRIPTION	LOCATING FUNCTION
A1	Std Navy: N17-M-88180-3019	MOUNTING: CRS; grey enamel finish; rectangular shape; over-all dim. 8¾ in. lg, 4 in. wd, 5/16 in. d; six mtg holes, three 0.152 in. dia holes on a center line 3/16 in. fom ea lg edge of plate, 4-3/16 in. between centers; has five 8-32 clinch nuts, silk-screened; 115 v 60 cyc, and Sig Input: used to mount a five term. barrier strip; Times Facsimile Corp, part/dwg No. 43C-21-00-20 Rev. A.	Holds barrier strip.
A2	Std Navy: N16-C-10630-9408	CABINET, ELECTRICAL EQUIPMENT: one compartment; steel; zinc chromate prime paint with grey enamel finish; over-all dim. 19⅝ in. lg, 14¾ in. wd, 12½ in. h; mtg method 1: one group of four 9/32 in. dia holes spaced 2½ in. by 2½ in. located at each of four corners at bottom of cabinet to accommodate Barry Corp. No. C-2035-T6 shock mts or equivalent; hole centers located as follows: 13⅜ in. by 9 in., 18⅜ in. by 9 in., 13⅜ in. by 14 in., and 18⅜ in. by 14 in.; mtg method 2: four ¼ in. dia holes spaced 15 15/16 in. by 11¾ in. between centers on bottom of cabinet; not waterproof or watertight; has four 10-32 clinch nuts located underneath top of cabinet spaced 15 15/16 in. by 11¾ in., has four dimples on top of cabinet ea 15/16 in. dia by ⅛ in. d, spaced 15⅛ in. by 11¾ in. between centers; has six 6-32 clinch nuts on upper rear of cabinet to accommodate an electrical connector mtg plate; has 16 louvers on ea side; has caution instructions in front of cabinet; Times Facsimile Corp, part/dwg No. 43C-21-00-10.	Encloses recorder.
A3	Std Navy: N16-S-469501-114	SLIDE ROLLER ASSY: consists of one ea RH support, LH support, RH guide roller assy, LH guide roller assy, and two tie plates; 18⅞ in. lg, 9½ in. h, 13⅛ in. d over-all; mtg data: two rows of three ea Boots Aircraft, F55S832S anchor nuts to accommodate 8-32 screws, nut centers spaced 3½ in. by 2¼ in. apart; painted grey; Times Facsimile Corp, part/dwg No. 43C-22-00-00.	Supports recorder in chassis.
A101	Std Navy: N17-M-88476-2494	MOUNTING, TRANSFORMER: aluminum; light grey enamel finish: over-all dim., 2 7/16 in. lg, 2 1/16 in. wd, and 1 17/32 in. h; has one 4-40 in. clinch nut on ea of two flanges; has 1 1/16 in. dia hole, and two 0.152 in. dia spaced 15/32 in. by 9/16 in. from the center of the 1 1/16 in. dia hole to accommodate a transfer; Times Facsimile Corp, part/dwg No. 41B-13-01-20.	Mounts T101.
A301	Std Navy: N16-C-650001-366*	COVER, ELECTRON TUBE: black bakelite; 2¼ in lg, 1 in. ID, 1 1/16 in. OD; incl caution label; Times Facsimile Corp, part/dwg No. 41-05-00-10.	Cover for V302.
A302	Std Navy: N17-B-750001-207	BRACKET: dial pointer "Z" shaped; steel, copper and nickel plated; 2 1/16 in. lg by ½ in h by ⅝ in. wd over-all; two 4-40 tapped holes .0312 in. C to C, 7/32 in. from one end; ⅜ in. dia hole ⅜ in. from other end; Times Facsimile Corp dial pointer bkt, part/dwg No. 90-05-05-08.	Bracket for dial pointer.
B401	Std Navy: N17-M-61891-1001	MOTOR, SELF-SYNCHRONOUS: phonic wheel type; oper power requirements: 15 W, 1800 cps, single phase; mechanical output data: 1/100 hp, 6 in. oz torque, single take-off shaft, 1800 rpm, ccw or cw rotation; closed frame; temp rise 60 deg C; continuous oper; HV term. cover; power take-off data: keyed shaft, 1/16 in. wd by 1/32 in. d keyway; motor dim.: 1 15/16 in. excluding shaft, 3⅞ in. dia, 1¼ in. dia shaft protruding 3 in. from one end; two solder lug term.; mtg data: two roller brg on shaft space 2⅜ in. apart and provision for spring-retaining housing; Times Facsimile Corp, part/dwg No. 42-06-00-00.	Recording drum speed synchronizer.

C1	Std Navy: N16-C-42736-8356	CAPACITOR, FIXED, PAPER DIELECTRIC: 10,000 mmf, plus or minus 10%, 600 v DC; JAN Type No. CN35A103K; Tobe; Spec. No. JAN-C-91.	RF bypass.
C2	x	Same as C1.	Coupling V1 to meter.
C3	x	Not used.	
C4	Sig C: 3K3522221 Std Navy: N16-C-31908-1608	CAPACITOR, FIXED, MICA: 2200 mmf, plus or minus 10%; 500 v DC; JAN Type No. CM35B222K; Aerovox; Spec. No. JAN-C-5.	Coupling to meter.
C5	Std Navy: N16-C-22573-7501	CAPACITOR, FIXED, ELECTROLYTIC: case style 13, MBCA Ref Dwg Group 1; three sect; 15 mf per sect; 450 v DC; minus 40 deg F to plus 149 deg F working temp range; HS metal can 2⅞ in. lg by 1⅜ in. dia; four pins ⅜ in. lg located at base spaced ½ in. by ½ in.; plugs into 0.687 in. dia circle std metal octal socket; case has precipitated nylon coating approx 0.015 in. thick; general purpose; Times Facsimile Corp, part/dwg No. 41-00-00-27.	B plus filter.
C6	x	Same as C5.	B plus filter.
C7	x	Same as C5.	B plus filter.
C8	Std Navy: N16-C-22736-3660	CAPACITOR, FIXED, ELECTROLYTIC: case style 13, MBCA Ref Dwg Group 1; three sect; 40 mf per sect; 250 v DC; minus 40 deg F to plus 185 deg F working temp range HS metal can 3½ in. lg by 1⅜ in. dia; four pins ⅜ in. lg located at base spaced ½ in. by ½ in.; plugs into 0.687 in. dia pin circle std metal octal socket; case has precipitated nylon coating approx 0.015 in. thick; general purpose; Times Facsimile Corp, part/dwg No. 41-00-00-26.	B plus filter.
C9	x	Not used.	
C10	Sig C: 3DB2-142 Std Navy: N16-C-49221-9883	CAPACITOR, FIXED, PAPER DIELECTRIC: 2 mf plus 20% minus 10%; 600 v DC; JAN Type No. CP53B1EF205V; Aerovox; Spec No. JAN-C-25.	Coupling V203 to phasing actuator.
C11	Std Navy: N16-C-32721-9493	CAPACITOR, FIXED, MICA: 5100 mmf plus or minus 5%, 2500 v DC; JAN Type No. CM50A512J; Aerovox; Spec No. JAN-C-5.	Motor tuning.
C12	x	Same as C11.	Motor tuning.
C13	Std Navy: N16-C-44287-6663	CAPACITOR, FIXED, PAPER DIELECTRIC: 50,000 mmf plus or minus 20%, 600 v DC; JAN Type No. CP25A1EF503M; Spec No. JAN-C-25.	Provides AC ground.
C14	Std Navy: N16-C-31091-6112 Sig C: 3K4510211	CAPACITOR, FIXED, MICA DIELECTRIC: 1000 mmf plus or minus 10%, 2500 v DC; JAN Type No. CM45A102K; Aerovox; Spec No. JAN-C-5.	RF suppressor.

* Not furnished as a maintenance part. If failure occurs, do not request replacement unless the item cannot be repaired or fabricated.

TABLE 8–4. TABLE OF REPLACEABLE PARTS—Cont.

REF. DESIG.	STOCK NUMBER: SIGNAL CORPS, STANDARD NAVY, AIR FORCE	NAME AND DESCRIPTION	LOCATING FUNCTION
C101	x	Same as C1.	V101A plate to V102B grid coupling.
C102	x	Same as C1.	V102B plate to V101B grid coupling.
C103	x	Not used.	
C104	Std Navy: N16-C-30188-4991	CAPACITOR, FIXED, MICA: 510 mmf plus or minus 5%; 500 v DC; JAN Type No. CM20A511J; Aerovox; Spec No. JAN-C-5.	V102B plate RF bypass.
C201	x	Same as C1.	V202B plate to V203 grid coupling.
C202	x	Same as C1.	V202B plate filter.
C203	x	Same as C1.	15 kc osc feedback coupling.
C204	x	Same as C1.	15 kc output coupling.
C205	x	Same as C1.	Z201 to V202B coupling.
C206	x	Same as C104.	V202A plate to V201A grid coupling.
C207	Sig C: 3DA500-451 Std Navy: N16-C-47321-9648	CAPACITOR, FIXED, PAPER DIELECTRIC: 0.5 mf plus 20% minus 10%; 600 v DC; JAN Type No. CP53B1EF504V: Aerovox; Spec No. JAN-C-25.	V201A cathode bypass.
C208	x	Same as C207.	V202B grid leak bias.
C301	x	Same as C207.	V302 cathode bypass.
C302	x	Same as C1.	Couples V301A plate to V302 grid.
C303	x	Same as C1.	V302 screen grid bypass.
C304	x	Same as C1.	V302 output.
C305	Std Navy: N16-C-45814-9335	CAPACITOR, FIXED, PAPER DIELECTRIC: 100,000 mmf plus or minus 20%; 600 v DC; JAN Type No. CP25A1EF104M; Aerovox; Spec No. JAN-C-25.	Fork feedback from V301B.

CR1	Std Navy: N17-R-51401-8609	RECTIFIER, METALLIC: selenium; designed for single phase, half-wave circuit, MBCA Ref Dwg Group 23; input data: 130 v AC single phase; output data: 125 v DC, 200 ma half-wave rectification; physical data: rectangular shape, over-all dim.; $1^{31}/_{32}$ in. lg incl term by $1^{17}/_{32}$ in. wd by 1 in. thick; one $5/_{32}$ in. dia mtg hole; two solder lug term., located opposite sides; general purpose; Fed Tele & Rad No. 1006; Times Facsimile Corp, part/dwg No. 41-00-00-24.	High B plus supply rectifier.
CR2	x	Same as CR1.	High B plus supply rectifier.
CR3	x	Same as CR1.	High B plus supply rectifier.
CR4	x	Same as CR1.	Low B plus rectifier.
CR5	Std Navy: N16-T-51734-10 or Std Navy: N16-T-51748	CRYSTAL UNIT, RECTIFYING: germanium type; 0.040 amp max continuous forward current; 60 v peak inverse voltage; 1 mmf shunt capacitance; body dim. excluding term. $3/_4$ in. lg by $3/_{16}$ in. dia; term. mtd; two axial wire lead term. one at ea end; glass body; general purpose; Sylvania Prod, No. 1N34A. or CRYSTAL UNIT, RECTIFYING: germanium type; 0.050 amp max continuous forward current; 85 v peak inverse voltage; 0.8 mmf shunt capacitance; body dim. excluding term. $1^{1}/_{32}$ in. lg by $1^{3}/_{64}$ in. dia; term. mtd; two axial wire lead term.; general purpose; GE germanium diode Type No. 1N48.	Meter rectifier.
CR6	x	Same as CR5.	Meter rectifier.
CR7	x	Same as CR5.	Meter rectifier.
CR8	x	Same as CR5.	Meter rectifier.
CR201	x	Same as CR5.	DC keying limiter.
E1	Std Navy: G17-L-6806-120	LAMP, GLOW: 1/25 W; 65 v AC striking voltage, 90 v DC striking voltage; lamp data: MBCA Ref Dwg Group 7, two wire lead base, clear T-2 bulb, orange-color light, two light duty W-11 electrodes, max over-all height $1^{1}/_{16}$ in. excluding wire leads; over 25 hr rated life; any burning position; neon gas; 200,000-ohm external resistor required for 105-125 v oper; general purpose; GE No. NE-2.	V1 open fil indicator.
E2	x	Same as E1.	V2 open fil indicator.
E3	x	Same as E1.	V3 open fil indicator.
E4	x	Same as E1.	V4 open fil indicator.
E5	x	Not used.	
E6	x	Same as E1.	V6 open fil indicator.
E7	x	Same as E1.	V7 open fil indicator.

TABLE 8–4. TABLE OF REPLACEABLE PARTS—Cont.

REF. DESIG.	STOCK NUMBER: SIGNAL CORPS, STANDARD NAVY, AIR FORCE	NAME AND DESCRIPTION	LOCATING FUNCTION
E8	Std Navy: G17-L-6806-130	LAMP, GLOW: 1/25 W; 65 v AC striking voltage, 90 v DC striking voltage; 200,000-ohm external resistor required for 105-125 v oper; GE No. NE51; Times Facsimile Corp, part/dwg No. 05-00-00-17.	Pilot light.
E9	x	Same as E8.	High B plus blown fuse indicator.
E10	x	Not used.	
E11	Std Navy: N17-F-74267-5075	FUSE HOLDER: extractor post type; 500 v, 15 amp max; accommodates one fuse, cartridge type 1¼ in. lg. by ¼ in. dia; over-all dim.: 2⅛ in. by 7/16 in. dia excluding lockwasher and hex nut; ½ in. dia mtg bushing; removable cap; two solder lug term.; Buss type HKP; Times Facsimile Corp, part/dwg No. 41-00-00-08.	For 3AG high B plus fuse.
E12	Sig C: 3Z1939.1 Std Navy: N17-F-74267-6101	FUSE HOLDER: extractor post type; 250 v, 18 amp max; accommodates one fuse, cartridge type, 1¼ in. lg. by 5/32 in. dia; Buss Type HCM-JEQZ; Times Facsimile Corp, part/dwg No. 12-00-33-00.	For 4AG power fuse.
E13	Std Navy: N17-P-69142-3381 Sig C: 3Z246A	POST, BINDING: cap base: brass, nickel plated; over-all height of post above mtg. surface, cap opened: 15/16 in., OD of post ½ in., with mtg stud, ½ in. lg, 8-32 thd; 5/32 in. max dia wire hole; nonremovable cap; nonturning device consisting of dowel on 9/16 in. radius; general purpose; Eby, Sergeant No. 7198 binding post; Times Facsimile Corp, part/dwg No. 90-00-86-00.	For external ground connection.
E14	x	Same as E12.	For 4AG power fuse.
E15	Std Navy: N17-B-77483-6937*	TERMINAL BOARD: molded phenolic: incl. one solder lug term. 1⅛ in. lg, ⅜ in. wd, 1½ in. h over-all; one ⅛ in. dia mtg hole; Amer Rad Hdwe lug strip No. 512; Times Facsimile Corp, part/dwg No. 12-05-01-06.	Provides junction for R6, R51 and R52.
E16	x	Same as E15.	Provides junction for E7, R53 and R54.
E17	x	Same as E15.	Provides junction for E4 and R50.
E18	x	Same as E15.	Provides junction for E3 and R49.
E19	x	Same as E15.	Provides junction for E2 and R48.
E20	x	Same as E15.	Provides junction for E1 and R47.

E21	Std Navy: N17-B-77533-8542*	TERMINAL BOARD: molded phenolic; two solder lug term.; 1 1/16 in. lg, 1 1/8 in. wd, 1/2 in. h over-all; one 1/8 in. mtg hole; Radio Essentials No. 5201; Times Facsimile Corp, part/dwg No. 90-15-23-00.	Support for R30 and R40.
E22	Std Navy: N17-I-64101-4095	INSULATOR, PLATE: XP grade bakelite; moisture and fungus proof varnish; no voltage rating; flat rectangular shape, MBCA ref dwg group 9; item code No. 185; dim. as indicated: J=1/2 in., K=13/64 in., L=3 25/32 in., N=0.29 in. dia, T=1/32 in., W=1 1/2 in.; mtg data: four 0.209 dia mtg holes located 3 3/8 in. by 1/2 in. centers; Jones HB catalog No. MSX-5-142-FV with no markings; general purpose; Times Facsimile Corp, part/dwg No. 43C-00-00-03.	Insulator for TB3.
E101	x	Same as E1.	V101 open fil indicator.
E102	x	Same as E1.	V102 open fil indicator.
E103	x	Same as E1.	V103 open fil indicator.
E104	Std Navy: N17-B-77536-4064	TERMINAL BOARD: molded phenolic; incl two term. posts, screwcap type; over-all dim.: 2 1/8 in. by 1 9/16 in. by 3/4 in.; two tapped No. 6-32 holes spaced 1 11/16 in. C to C; two removable solder lugs; general purpose; National Co No. FWG; Times Facsimile Corp, part/dwg No. 16-00-13-00. Starting with serial No. 1030 input terminal board replaced by 2 ea binding post insulators TFC part/dwg 41-13-01-02 (General Radio Co catalog 938Z with 1/16 in. milled off ea straight edge), binding posts TFC part/dwg 41C-13-01-03 (General Radio Co catalog 938A with Ni pl brass washer, 6-32 Ni pl brass hex nut & No. 6 Ni pl split washer, with shaft length below mtg surface cut off to 5/8 in. lg) and washer TFC part/steel dwg 41C-13-01-04, .150 in. ID (General Radio Co catalog WAM-56).	Input terminals.
E105	x	Same as E15.	Provides junction for E102 and R111.
E106	x	Same as E15.	Provides junction for E101 and R110.
E107	x	Same as E15.	Provides junction for E103 and R112.
E201	x	Same as E1.	V201 open fil indicator.
E202	x	Same as E1.	V202 open fil indicator.
E203	x	Same as E1.	V203 open fil indicator.
E204	x	Same as E15.	Provides junction for E201 and R219.
E205	x	Same as E15.	Provides junction for E202 and R220.
E206	x	Same as E15.	Provides junction for E203 and R221.
E301	x	Same as E1.	V301 open fil indicator.
E302	x	Same as E1.	V302 open fil indicator.
E303	x	Same as E15.	Provides junction for E301 and R313.
E304	x	Same as E15.	Provides junction for E302 and R314.

* Not furnished as a maintenance part If failure occurs, do not request replacement unless the item cannot be repaired or fabricated.

TABLE 8–4. TABLE OF REPLACEABLE PARTS—Cont.

REF. DESIG.	STOCK NUMBER: SIGNAL CORPS, STANDARD NAVY, AIR FORCE	NAME AND DESCRIPTION	LOCATING FUNCTION
E401	Std Navy: N17-W-52817-2876	WINDING, MOTOR FIELD: winding data: single random wound; 0.3 amp; 1200 turns, No. 28½ formex; 115 v 60 cps; two wire leads; over-all dim. excluding leads: 3⅛ in. by 2 in. by 1½ in.; varnish impr; lam iron core; cotton tape ins; four 5/32 in. dia mtg holes spaced 1½ in. by 1 1/32 in.; for shaded pole AC motor; general purpose; Alliance Mfg Field Winding for Motors Models MS; Times Facsimile Corp, part/dwg No. 42-16-01-01.	Start motor field.
E402	x	Same as E401.	Run motor field.
E403	Std Navy: N-17-E-32201-1112	ELECTROMAGNETIC ACTUATOR: armature type moving element; 0.23 in. lin stroke; electrical data: 250 v pulse, 120 ma peak current, 1650 to 1950 ohms resistance, nonpolarized, ungrounded coil; term. data: two ¼ in. lg solder lug term.; over-all dim, excluding term.; 1¾ in. lg by 1½ in. wd by 13/16 in. h; one 5/32 in. dia mtg hole spaced 1 7/16 in. C to C; Times Facsimile Corp, part/dwg No. 42-36-00-00.	Phasing actuator.
E404	Std Navy: N17-W-52804-6626	WINDING, MOTOR FIELD: 600 turns No. 36 heavy formex single random wound winding; two wire lead term. located on one side; body dim.: ⅞ in. lg by 0.437 in. wd by 0.343 in. d; varnish impr; wound on nylon bobbin; outside cover three layers of cellulose acetate; bobbin slips on to core having 0.14 in. by 0.320 in. rectangular cross section; Times Facsimile Corp, part/dwg No. 42-06-02-25.	Sync motor field coil.
E405	Std Navy: N17-W-52804-6636	WINDING, MOTOR FIELD: same as E404 except inner and outer leads reversed; Times Facsimile Corp, part/dwg No. 42-06-02-26.	Sync motor field coil.
E406	Std Navy: N17-E-32201-1113	ELECTROMAGNETIC ACTUATOR: armature type moving element; 0.040 in. lin stroke; electrical data: oper by 15 mf capacitor that has been charged from 300 v source, 1 amp, peak current, 300 ohms resistance, nonpolarized, ungrounded coil; two ⅛ in. lg solder lug term.; over-all dim. excluding term. and moving element: 1½ in. lg by ⅝ in. wd by ⅝ in. h; two No. 4-40 tapped mtg holes spaced ⅜ in C to C; Times Facsimile Corp, part/dwg No. 42-17-04-00.	Carriage release actuator.
E407	Std Navy: N17-I-64073-3110 Sig C: 3G320-223	INSULATOR, PLATE: Lumarith CA, clear plastic; 7500 v working; flat rectanguar shape; 2 in. lg, 0.015 in. thick, 0.8125 in. wd; three rectangular mtg holes (two holes 0.188 in. by 0.375 in. and one hole ⅛ in. by 5/16 in.) spaced such that one short side of each hole is 5/32 in. from same lg side of ins plate and the longitudinal center lines of the holes spaced 0.629 in. apart; Times Facsimile Corp, part/dwg No. 26-06-01-67.	Insulator in sync motor B401.
E408	x	Same as E21.	Support for R401.
E409		TERMINAL BOARD: molded phenolic; three solder lug term.; 1⅞ in. lg, 11/16 in. wd, ½ in. h; two ⅛ in. dia mtg holes spaced 1½ in. C to C; Radio Essentials No. 5302A, Times Facsimile Corp, part/dwg No. 42-00-19-00.	Triple tie lug in U4.

F1	Std Navy: N17-F-16302-30	FUSE, CARTRIDGE: 1/8 amp, 250 v; instantaneous oper; Littlefuse catalog No. 312.125; Times Facsimile Corp, part/dwg No. 34-00-00-19.	High B plus fuse.
F2	Std Navy: N17-F-14310-560	FUSE, CARTRIDGE: 2 amp, 250 v; time delay oper; life 110% overload rated, 135% for 0 to 1 hour, 200% for 0 to 2 min; Littlefuse No. 413002; Times Facsimile Corp, part/dwg No. 41-00-00-38.	Power line fuse.
F3	x	Same as F2.	Power line fuse.
H1	Std Navy: N41-P-53251-2180	PLIERS: for use with Waldes Kohinoor Truarc retainer; noncutting, nonadjustable, normally closed jaws; non-insulated, spring loaded, normally open handles; parkerized steel; one pair of auxiliary fixed jaws; 5 3/8 in. max over-all lgth; Waldes Plier No. 0018; general purpose; Times Facsimile Corp, part/dwg No. 41B-00-00-31.	For installing and removing Truarc retainers.
H2	Std Navy: N41-P-1992-27	PLIERS: for use with Waldes Kohinoor Truarc retainer; noncutting, normally closed adjustable jaws; noninsulated, spring loaded, normally open handles; parkerized steel; bkt and set screw for jaw adjustment; 6 in. max over-all lgth; general purpose; Waldes Plier No. 2, Times Facsimile Corp, part/dwg No. 41B-00-00-32.	For installing and removing Truarc retainers.
H3	Std Navy: N16-W-920001-151*	WRENCH: blade data: two 1/16 in. wd, 1/16 in. thick, 3/32 in. lg prongs, spaced 0.185 in. apart from end of a 5/16 in. dia. shank having a 0.185 in. dia. and 1 in. lg d hole; shank data: chrome-vanadium steel, 5/16 in. dia. by 3 in. lgth, "T" shaped CRS handle; for Times Facsimile Corp, part/dwg No. 42-16-01-10 coupler subassy retaining nut; part of Times Facsimile Recorder Model RG; Times Facsimile Corp, part/dwg No. 41B-00-00-30.	For installing and removing nut H418.
H4	Std Navy: N16-R-651091-275	RING RETAINER: annular shape; type 302 stainless steel; dim. 0.415 in. OD, 9/32 in. dia. hole with 1/16 in. wd segment removed, 1/16 in. thick; Times Facsimile Split Ring, part/dwg No. 41-00-01-03.	Retainer for H6.
H5	x	Same as H4.	Retainer for H7.
H6	Std Navy: N43-W-99500-60	WASHER, FLAT: "C" shaped; type 302, stainless steel; dim. 0.390 in. OD, 0.145 in. ID, radial slot, 0.0371 in. lgth from circum with 0.0725 in. radius at end, 1/32 in. thk; Times Facsimile Corp Captive Screw Retainer, part/dwg No. 41-00-00-15.	Retainer for H8.
H7	x	Same as H6.	Retainer for H9.
H8	Std Navy: N16-S-118401-158	SCREW, THUMB: dull nickel plated steel; cylindrical, med diamond knurl, finger-grip drive, head 23/32 in. lg by 1/2 in. dia; cone point; 12-24 NCT, class 2 fit, 9/64 in. min lgth; 15/32 in. nom lgth 1 3/16 in. o/a lgth; Times Facsimile Corp, part/dwg No. 41B-00-00-14-B.	Fastens chassis to cabinet.
H9	x	Same as H8.	Fastens chassis to cabinet.
H201	Std Navy: N16-C-300767-995	CLAMP, LOCKING: brass, nickel plated finish; two friction gripping type fasteners; over-all dim. 5/8 in. lg hex cross section 7/16 in. across flats; one 11/32 in. (.343) drilled hole 7/16 in. d tapped 3/8-32, 5/16 in. d; designed to lock controls having 1/4 in. dia. shafts and 3/8-32 threaded bushing; Times Facsimile Corp, part/dwg No. 26-00-45-00.	Locking device for R222.

* Not furnished as a maintenance part. If failure occurs, do not request replacement unless the item cannot be repaired or fabricated.

TABLE 8–4. TABLE OF REPLACEABLE PARTS—Cont.

REF. DESIG.	STOCK NUMBER: SIGNAL CORPS, STANDARD NAVY, AIR FORCE	NAME AND DESCRIPTION	LOCATING FUNCTION
H202	Std Navy: N17-P-69720-5601	POST, SPACING: brass, nickel plated finish; cylindrical shape over-all dim. 31/32 in. lg, 5/16 in. dia, 0.152 in. dia mtg hole concentric with longitudinal axis 31/32 in. lg; general purpose; Times Facsimile Corp, part/dwg No. 41-14-01-02.	Spacer for mtg "Bathtub" type cans.
H203	x	Same as H202.	Spacer for mtg "Bathtub" type cans.
H204	x	Same as H202.	Spacer for mtg "Bathtub" type cans.
H205	x	Same as H202.	Spacer for mtg "Bathtub" type cans.
H206	x	Same as H202.	Spacer for mtg "Bathtub" type cans.
H207	x	Same as H202.	Spacer for mtg "Bathtub" type cans.
H401	Std Navy: N42-P-99500-84	PIN: SAE 1090 steel, bonderize finish; cylindrical shape; 0.078 in. dia, 7/16 in. lg; Times Facsimile Corp, part/dwg No. 42-16-03-12.	Pin in 0432.
H402	x	Same as H4.	Retainer for H404.
H403	x	Same as H4.	Retainer for H405.
H404	x	Same as H6.	Retainer for H414.
H405	x	Same as H6.	Retainer for H415.
H406	Std Navy: N43-W-3045-64*	WASHER, FLAT: annular shape; brass; 0.0005 in. nickel plated finish; dim. 5/16 in. OD, 0.193 in. ID, 0.046 in. thick; Times Facsimile Corp, part/dwg No. 42-16-03-01.	Spacer in U4.
H407	Std Navy: N43-W-3045-63*	WASHER, FLAT: annular shape; stainless steel; dim. 5/16 in. OD, 0.189 in. ID, 1/64 in. thick; Times Facsimile Corp, Thin Spacer, part/dwg No. 42-16-02-07.	Gear spacer in U4.
H408	x	Same as H407.	Gear spacer in U4.
H409	Std Navy: N43-W-3045-150*	WASHER, FLAT: round; brass; 0.0005 in. nickel plated finish; dim. 1/2 in. OD, 0.376 in. ID, 0.010 in. thick; Times Facsimile Corp, part/dwg No. 42-16-00-02.	Spacer in U4.
H410	x	Same as H409.	Spacer in U4.
H411	x	Same as H409.	Spacer in U4.

H412	Std Navy: N43-S-99500-137	SCREW, DOWEL: type 303 stainless steel; passivated finish; flat top binding head, 1/8 in. high, 5/16 in. dia; slot drive; slot dim.: 3/64 in. wd, 1/16 in. d, 5/16 in. lg; flat point; nom lgth. 7/16 in.; threaded portion: 5/16 in. lg with 8-32 NCT; dowel: 1/4 in. lg, 1.187 in. dia. between head and threaded portion, Times Facsimile Corp, part/dwg No. 42-00-00-23.	Locating screw in U4.
H413	x	Same as H412.	Locating screw in U4.
H414	x	Same as H8.	Fastens recorder to cabinet.
H415	x	Same as H8.	Fastens recorder to cabinet.
H416	x	Same as H401.	Driving pin in drum 0476.
H417	x	Same as H401.	Pin in gear assy 0431.
H418	Std Navy: N16-N-88601-1039	NUT, PLAIN, ROUND: stainless steel; passivated finish; no locking feature; 1/16 in. slot drive; 3/8-32 in. NCT; class 2 fit; dim. 1/2 in. OD, 7/16 in. over-all height; Times Facsimile Corp retaining nut, part/dwg No. 42-16-01-10.	Secures drive subassembly 0464.
HE1	Std Navy: N17-C-812396-101*	CLIP: beryllium copper; holds supported item by spring fingers; 5/8 in. lg by 0.280 in. wd and approx 1/8 in. h; mtd to supporting object or surface by one 0.152 in. dia hole; hardened to Rockwell C 35 to 40; for mtg GE type NE2 glow lamps; Times Facsimile Corp, part/dwg No. 41-00-00-02.	Holder for E1.
HE2	x	Same as HE1.	Holder for E2.
HE3	x	Same as HE1.	Holder for E3.
HE4	x	Same as HE1.	Holder for E4.
HE5	x	Not used.	
HE6	x	Same as HE1.	Holder for E6.
HE7	x	Same as HE1.	Holder for E7.
HE101	x	Same as HE1.	Holder for E101.
HE102	x	Same as HE1.	Holder for E102.
HE103	x	Same as HE1.	Holder for E103.
HE201	x	Same as HE1.	Holder for E201.
HE202	x	Same as HE1.	Holder for E202.

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REF. DESIG.	STOCK NUMBER: SIGNAL CORPS, STANDARD NAVY, AIR FORCE	NAME AND DESCRIPTION	LOCATING FUNCTION
HE203	x	Same as HE1.	Holder for E203.
HE301	x	Same as HE1.	Holder for E301.
HE302	x	Same as HE1.	Holder for E302.
I301	Std Navy: N17-F-61127-8109	FORK, TUNING: fixed frequency, 1800 cps; body dim. 4¾ in. by 2$^{9}/_{16}$ in. by 1⅝ in.; three solder lug term.; HS in vacuum metal case; temp compensated 0°C to plus 65°C; high stability; accuracy 10 parts per million from 0° to 65°C; one hole in each of 4 mtg flanges, hole centers spaced 3⅛ in. by 2$^{25}/_{32}$ in.; Times Facsimile Corp, part/dwg No. 41-05-04-00.	1800 cycles source.
I302	Std Navy: N16-S-117101-557*	SCALE: consists of dial, Times Facsimile Corp, part/dwg No. 12-05-06-01, dial bushing, Times Facsimile Corp, part/dwg No. 12-05-06-02, and one 6-32 by ⅛ in. SHCP set screw; 1⅞ in. by $^{21}/_{64}$ in. lg over-all; dial marked with 50 graduations, every fifth marked 0, 10, 20 . . . 90, 100; Times Facsimile Corp Dial Assy, part/dwg No. 12-05-06-00.	Indicates potentiometer (R312) setting.
J1	Std Navy: N17-I-36480-5468	INSERT, ELECTRICAL CONNECTOR: high dielectric type; contact data: 15 round female contacts, 12 No. 20 contacts, 3 No. 12 contacts, 500 v, 5 amp for No. 20 contacts; 25 amp for No. 12 contacts; rectangular phenolic body; over-all dim.: 1½ in. lg by ¾ in. wd by 1$^{1}/_{32}$ in. thick incl term.; two ⅛ in. dia. mtg holes spaced 1$^{3}/_{16}$ in. C to C polarized; general purpose; Amphenol Catalog No. 26-150; Times Facsimile Corp, part/dwg No. 41-00-00-07.	Connects U4 to U5.
J2	x	Same as J1.	Connects U2 to U5.
J3	x	Same as J1.	Connects U1 to U5.
J4	x	Same as J1.	Connects U3 to U5.
J5	Std Navy: N17-C-72273-4276	CONNECTOR, RECEPTACLE: 14 contacts, female round; polarized; 10 amp for No. 16 contacts, 200 v peak; Jan Type AN 3102-20-1S; Times Facsimile Corp, part/dwg No. 41-40-00-05.	Connects recorder to auxiliary equipment.
J6	Std Navy: N16-C-72263-4966	CONNECTOR, RECEPTACLE: 8 round female contacts; polarized straight type; 10 amp, for No. 16 contacts 200 v peak; JAN Type AN-3102-20-7S; Cannon Elec No. 2062-34; Times Facsimile Corp, part/dwg No. 41B-40-00-07.	Connects recorder to auxiliary equipment.
J7	Std Navy: N17-C-73470-1265 Sig C: 6Z7798-4	CONNECTOR, RECEPTACLE: contact data: three male contacts, one round and two curved; polarized; straight type; over-all dim.: 2$^{1}/_{16}$ in. lg 1$^{7}/_{16}$ in. wd, 1 in. h; contact rating: 15 amp, 125 v not for RF; body data: cylindrical body with oval metal mtg flange, bakelite locking type; mtg data: two $^{5}/_{32}$ in. dia mtg holes spaced 1¾ in. C to C; flush type mount with twist lock contacts requiring 1¼ in. hole; Hubbell catalog No. 7486; Times Facsimile Corp, part/dwg No. 61-15-00-05.	AC power connector.

K1	Std Navy: N17-R-65557-3210	RELAY, ARMATURE: contact data: contact arrangement data: contact arrangement 1A2B1C, single break, 3 amp AC non-inductive, 6200 ohms, 110v D-C term, data: solder lugs, nine on contacts, two on coil; continuous duty; over-all dim. 1 17/32 in. by 1 1/4 in. by 1 in.; two No. 5-40 tapped holes, spaced 7/16 in. C to C; general purpose; Clare Mfg No. A-51205; Times Facsimile Corp, part/dwg No. 41-40-04-00.	Start relay.
K2	Std Navy: N17-R-65150-8241	RELAY, ARMATURE: contact data: contact arrangement MBCA Ref Dwg Group 4, form 2B, single break, 3 amp AC, 150 W, non-inductive; coil data: single winding, inductive, 300 ohms, 24 v dc; term. data: solder lug term. two on contacts, two on coil; continuous duty; over-all dim. 1 17/32 in. by 1 in. by 1 in.; two 5-40 tapped mtg holes spaced 7/16 in. between centers; general purpose; Clare Mfg No. A-30566; Times Facsimile Corp, part/dwg No. 41-40-05-00.	Trip relay.
L201	Std Navy: N16-R-28934-8486	REACTOR: audio reactor; 1 sect; electrical data: 1 plus or minus 0.05 henrys, 5 ma dc; 270- to 330-ohm dc resistance; 1000 v rms, 60 cps test voltage; HS metal case; over-all dim.; 2 1/2 in. by 1 in. by 1 in.; two 5/32 in. dia mtg holes 2 1/8 in. C to C; two solder lug term. on side; Times Facsimile Corp, part/dwg No. 41B-11-05-00-B.	Plate load for V202A.
M1	Std Navy: N17-M-21878-6231	METER, ARBITRARY SCALE: panel mtd; for D-C circuit; scale data: measurement inscription 0 to 200 left to right, graduated in increments of 5, scale marked at 0, 50, 100, 150, and 200; case data: style 15, MBCA Ref Dwg Group 27 round bakelite; dim.; 2.69 in. dia flange, 2.2 in. dia body, 0.89 in. body depth; accuracy plus or minus 2% at full scale reading; sensitivity 1 ma dc for full scale deflection; calibrated for nonmagnetic panel; black scale markings on white background; self-contained; three 1/8 in. dia mtg holes on 1 7/32 in. radius, spaced 120 deg apart; two No. 8-32 screw stud term., 0.53 in. lg Times Facsimile Corp, part/dwg No. 41-00-00-13.	Circuit test meter.
MS401	Std Navy: N16-S-705001-103*	STRING: nylon type FM-10001; solid; 1/32 in. dia; natural color; 17 in. lg; Times Facsimile Corp, part/dwg No. 42-18-04-01.	To return stylus carriage.
01	Std Navy: N16-R-503580-212	RETAINER, ELECTRON TUBE: stainless steel; over-all dim.: 2 in. lg, 1 15/32 in. w, 29/32 in. d; mts on 8-32 stud by means of slot in tab; distance from center of retained tube to r.tg stud 29/32 in.; 3/16 in. dia. hole in top; Times Facsimile Corp catalog No. 2, part/dwg No. 2000.	Retainer for V1.
02	x	Same as 01.	Retainer for V2.
03	x	Same as 01.	Retainer for V3.
04	x	Same as 01.	Retainer for V4.
05	x	Same as 01.	Retainer for V5.
06	Std Navy: N16-R-503580-211	RETAINER, ELECTRON TUBE: stainless; over-all dim.; 1 13/16 in. dia by 3/16 in. excluding tab; mts on stud by means of slot in tab; used to hold electron tube in socket; Times Facsimile Corp catalog No. 3, part/dwg No. 3000.	Retainer for V6.

* Not furnished as a maintenance part. If failure occurs, do not request replacement unless the item cannot be repaired or fabricated.

TABLE 8-4. TABLE OF REPLACEABLE PARTS—Cont.

REF. DESIG.	STOCK NUMBER: SIGNAL CORPS, STANDARD NAVY, AIR FORCE	NAME AND DESCRIPTION	LOCATING FUNCTION
07	Std Navy: N16-R-503580-210	RETAINER, ELECTRON TUBE: stainless steel; over-all dim. 2⅛ in. dia by 5/16 in. excluding tab; mts on stud by means of slot in tab; used to hold electron tube in socket; Times Facsimile Corp catalog No. 4, part/dwg No. 4000.	Retainer for V7.
08	Std Navy: N16-R-503580-213	RETAINER, CAPACITOR: stainless steel; over-all dim. 1½ in. by 3/16 in. excluding tab; mts on stud by means of slot in tab; used to hold capacitor in socket; Times Facsimile Corp catalog No. 3T, part/dwg No. 3010.	Retainer for C5.
09	x	Same as 08.	Retainer for C6.
010	x	Same as 08.	Retainer for C7.
011	x	Same as 08.	Retainer for C8.
012	Std Navy: N16-K-700627-101	KNOB: bar w/single pointer, Ref Dwg Group 16; plastic, black, natural finish; plain gripping surface; 1 13/16 in. lg, 1⅛ in. wide, 13/16 in. thick overall; 1⅛ in. OD integrally molded skirt; designed to accomodate ¼ in. dia round unthreaded shaft, ½ in. d hole; 1 set screw hole, 4-40 thread size, w/set screw; radial white line depressed marking; United States Instrument Co. catalog no. 1627; TFC part/dwg no. 41-00-00-81.	Knob for S1.
013	x	Same as 012.	Knob for S4.
014	x	Same as 012.	Knob for R38.
015	Std Navy: N16-K-700271-601	KNOB: round shape; bakelite; black; designed to accommodate ¼ in. dia shaft, 5/16 in. shaft hole; no insert; over-all dim. 13/32 in. h by 11/16 in. dia; general purpose; Gen Cement No. 1114; Times Facsimile Corp, part/dwg No. 41-00-00-06.	Knob for R41.
016	Std Navy: N16-S-800661-175	STUD: stainless steel; no protective finish; over-all dim. excluding accessories; 3¼ in. lg 0.142 in. dia; has a No. 8-32 NCT ½ in. lg at one end and approx. 2 in. on opposite end; stud is mtd with the ½ in. long threaded end through a No. 18 (0.177 in. dia) hole and locked with two hex nuts and lockwashers; accessories: two No. 8 hex nuts and one No. 8 external lockwasher; Times Facsimile Corp catalog No. 32, dwg No. 3202.	Mounting post for retainer 01.
017	x	Same as 016.	Mounting post for retainer 02.
018	x	Same as 016.	Mounting post for retainer 03.
019	x	Same as 016.	Mounting post for retainer 04.

020	Std Navy: N16-S-800652-101	STUD: stainless steel; no protective finish; over-all dim. excluding accessories: 4¼ in. lg 0.142 in. dia, has a No. 8-32 NCT ½ in. lg on one end and a No. 8-32 NCT 1½ in. lg on the opposite end; stud is mounted with the ½ in. lg thd end through a No. 18 (0.177 in. dia) hole and locked with two hex nuts and a lockwasher; accessories: two No. 8 hex nuts and one No. 8 external lockwasher; Times Facsimile Corp catalog No. 42, dwg No. 4202.	Mounting post for retainer 05.
021	x	Same as 020.	Mounting for retainer 06.
022	x	Same as 020.	Mounting for retainer 07.
023	x	Same as 020.	Mounting for retainer 08.
024	x	Same as 020.	Mounting for retainer 09.
025	x	Same as 020.	Mounting for retainer 010.
026	x	Same as 020.	Mounting for retainer 011.
0101	x	Same as 01.	Retainer for V101.
0102	x	Same as 01.	Retainer for V102.
0103	x	Same as 01.	Retainer for V103.
0104	x	Same as 016.	Mounting for retainer 0101.
0105	x	Same as 016.	Mounting for retainer 0102.
0106	x	Same as 016.	Mounting for retainer 0103.
0201	x	Same as 01.	Retainer for V201.
0202	x	Same as 01.	Retainer for V202.
0203	Std Navy: N16-R-503580-183	RETAINER, ELECTRON TUBE: stainless steel; designed to retain 7-pin and 9-pin miniature type electron tubes; mts on No. 8-32 NCT stud by means of slot in metal tab; distance between centers of retained object and mtg stud 11/16 in., 21/32 in. dia hole on top; general purpose; Times Facsimile Corp catalog No. 1, part/dwg No. 1000.	Retainer for V203.
0204	x	Same as 016.	Mounting for retainer 0201.
0205	x	Same as 016.	Mounting for retainer 0202.
0206	Std Navy: N16-S-800650-101	STUD: stainless steel; no protective finish; over-all dim. excluding accessories: 2⅝ in. lg 0.142 in. dia; has a No. 8-32 NCT 1½ in. lg on one end and a No. 8-32 NCT ½ in. lg on opposite end; stud is mtd with the ½ in. lg thd end through a 0.177 in. dia hole and held in place with accessories consisting of two No. 8-32 hex nuts and one No. 8 external lockwasher; Times Facsimile Corp catalog No. 25, part/dwg No. 2502.	Mounting for retainer 0203.

TABLE 8–4. TABLE OF REPLACEABLE PARTS—Cont.

REF. DESIG.	STOCK NUMBER: SIGNAL CORPS, STANDARD NAVY, AIR FORCE	NAME AND DESCRIPTION	LOCATING FUNCTION
0301	x	Same as 01.	Retainer for V301.
0302	x	Same as 01.	Retainer for V302.
0303	x	Same as 016.	Mounting for retainer 0301.
0304	x	Same as 016.	Mounting for retainer 0302.
0305	Std Navy: N17-P-500001-104*	POINTER, INDICATOR: nickel plated steel; rectangular, 13/16 in. lg, 3/8 in. wd, 1/16 in. thick over-all; two No. 30 (0.128 in.) drilled holes 5/16 in. C to C and 1/8 in. from straight end; Times Facsimile Corp, part/dwg No. 90-05-05-09.	Pointer for dial I302.
0401	Std Navy: N17-S-50541-1006 Sig C. 6C295-4	STYLUS, RECORDING, REPRODUCING: tungsten needle point 0.008 in. dia by 1/8 in. lg; shank over-all dim.: 25/32 in. lg by 13/32 in. h by 0.062 in. thick; shank data: brass bent at 22 deg; will record on aprox fifty 12 in. by 19 in. sheets; total approx recording life 17 hr, slight depression on side of shank 3/32 in. from end opposite needle; Times Facsimile Corp, part/dwg No. 42-00-10-00.	Recording stylus.
0402	Std Navy: G77-B-115-00619-2000	BEARING, BALL: single row radial; double shield; light duty; 3/8 in. bore, 7/8 in. OD., 0.281 in. wd; 7 balls; standard fit; ABEC-1 tolerance; general purpose; ND No. 77R6; Times Facsimile Corp, part/dwg No. 42-16-01-17.	Bearing for shaft driving 0464.
0403	x	Same as 0402.	Bearing for shaft driving 0464.
0404	Std Navy: N77-B-115-00319-2000	BEARING, BALL: single row radial; double shield; light duty; 3/16 in. bore, 1 1/2 in. OD, 0.197 in. wd; 7 balls; standard fit; ABEC-1 tolerance; general purpose; ND No. 77R3; Times Facsimile Corp, part/dwg No. 01-12-03-04.	Shaft bearing for 0431.
0405	x	Same as 0404.	Shaft bearing for 0431.
0406	x	Same as 0404.	Shaft bearing for 0433.
0407	x	Same as 0404.	Shaft bearing for 0433.
0408	x	Same as 0404.	Shaft bearing.
0409	Std Navy: G77-B-115-00409-2000	BEARING, BALL: single row radial; double shield; light duty; 1/4 in. bore, 5/8 in. OD, 0.197 in. wd; 8 balls; standard fit; ABEC-1 tolerance; ND No. 77R4; Times Facsimile Corp, part/dwg No. 42-00-00-12.	Shaft bearing on motor B401.
0410	x	Same as 0409.	Shaft bearing for shaft 0465.

0411	x	Same as 0409.	Shaft bearing for shaft 0465.
0412	Sig C: 3H320-29 Std Navy: N77-B-111-00810-2050	BEARING, BALL: single row radial; double shield; 8 mm bore, 22 mm OD, 7 mm wd; 7 balls; high temp grease; tight fit; ABEC-5 tolerance; polished bore; Barden Mfg No. 38SSX3 with polished bore; Times Facsimile Corp, part/dwg No. 26-06-01-12.	Shaft bearing on motor B401.
0413	x	Same as 0412.	Shaft bearing on motor B401.
0414	x	Same as 0412.	Shaft bearing on motor B401.
0415	Std Navy: G77-B-111-00810-2000	BEARING, BALL: single row radial; double shield; light duty; 8 mm bore, 22 mm OD, 7 mm wd; 7 balls; standard fit; ABEC-1 tolerance; general purpose; SKF No. R82Z; Times Facsimile Corp, part/dwg No. 42-00-00-11.	Shaft bearing on drum shaft.
0416	x	Same as 0415.	Shaft bearing for drum shaft.
0417	Std Navy: N17-S-46768-5556	SPRING ASS'Y: thrust type; type 25S beryllium copper; 1¼ in. lg, .3125 in. wd, .208 in. deep; mtg data: two .089 in. holes spaced 3/16 in. C to C; Times Facsimile Corp, part/dwg No. 42-00-06-10.	Drum shaft thrust spring.
0418	x	Same as 0417.	Feed shaft 0465 thrust spring.
0419	Std Navy: N17-S-46730-8191	SPRING: helical extension; 0.013 in. dia stainless steel wire; ⅛ in. dia ½ in. lg; 20 turns; parallel hook term.; Times Facsimile Corp, part/dwg No. 42-00-00-20.	To return lever which actuates S6 and S8.
0420	Std Navy: N17-S-46836-1128	SPRING: motor type, beryllium copper strip, 3/16 in. wd, 60 in. lg; over-all dim.: ⅜ in. wd, 2 in. dia; mtg data: one 5/32 in. hole in center; Times Facsimile Corp, part/dwg No. 42B-18-02-00.	To return stylus carriage containing 0460 and 0461.
0421	Std Navy: N17-S-46707-1700	SPRING: helical extension type; 0.013 in. dia stainless steel wire; 11/32 in. lg, ⅛ in. dia; 7 turns; parallel hook term.; Times Facsimile Corp, part/dwg No. 42-17-00-14.	Detent latch spring.
0422	Std Navy: N17-S-46716-8121	SPRING: helical extension type; 0.013 in. dia, stainless steel wire; 11/32 in. lg, ⅛ in. dia; 13 turns; hook term.; Times Facsimile Corp, part/dwg No. 42-17-00-13.	Carriage release actuator.
0423	Std Navy: N17-S-46701-1801	SPRING: helical compression type; 0.032 in., stainless steel wire; ⅞ in. lg, 5/16 in. dia; 8 turns; squared ends ground; Times Facsimile Corp, part/dwg No. 42-17-00-05.	Half nut 0468 disengagement spring.
0424	Std Navy: N17-S-46701-9784	SPRING: helical compression type; 0.032 in., stainless steel wire; 1 1/16 in. lg, 5/16 in. dia; 10 turns; open ends ground; Times Facsimile Corp, part/dwg No. 42-17-00-04.	Half nut 0468 engagement load spring.
0425	Std Navy: N17-S-46743-6921	SPRING: helical extension type; 0.008 in., stainless steel wire; 13/32 in. lg, ⅛ in. dia; approx 19 turns; one hook and one eye term., indexed 90 deg close wound; Times Facsimile Corp, part/dwg No. 42-03-02-06.	Spring to pivot stylus holder 0460.

* Not furnished as a maintenance part. If failure occurs, do not request replacement unless the item cannot be repaired or fabricated.

TABLE 8-4. TABLE OF REPLACEABLE PARTS—Cont.

REF. DESIG.	STOCK NUMBER: SIGNAL CORPS, STANDARD NAVY, AIR FORCE	NAME AND DESCRIPTION	LOCATING FUNCTION
0426	Std Navy: N17-S-46764-7710	SPRING: flat type; 0.010 in. thick, beryllium copper type 25S, No. 1 hardened; 9/16 in. lg, 21/32 in. wd, 9/32 in. h; mtg data: two holes 0.128 in. dia spaced 1/4 in. C to C; two round shaped bearing surfaces; Times Facsimile Corp, part/dwg No. 42-16-01-08.	Motor B401 decoupler.
0427	Std Navy: N16-G-431695-924	GEAR: brass; straight teeth; 40 teeth; 48 pitch; 0.831 in. PD; 0.873 in. OD; bore D hole 0.250 in dia, 0.203 in. from flat; 1/4 in thick; straight face; counterbore 1/2 in. dia, 1/8 in. deep; Times Facsimile Corp, part/dwg No. 42-00-00-02.	Gear in shaft 0465 gear train.
0428	Std Navy: N16-G-431296-417	GEAR: spur; brass; straight teeth; 20 teeth; 48 pitch; PD 0.4166 in.; pressure angle 14 1/2 deg; 0.458 in. OD; bore: D hole 0.250 in. dia; 0.203 in. from flat; straight face; Times Facsimile Corp, part/dwg No. 42-00-09-03	Gear in shaft 0465 gear train.
0429	Std Navy: N16-G-431209-212	GEAR: spur; brass; teeth data: 16 straight teeth, 32 diametral pitch, PD 0.500 in.; 0.556 in. OD; bore: D hole 0.186 in. dia; 0.156 in. from flat; 11/64 in. thick; straight face; Times Facsimile Corp, part/dwg No. 42-00-00-04.	Pinion for shaft 0473.
0430	Std Navy: N16-G-423525-122	GEAR, CIRCULAR RACK: spur; naval bronze; straight teeth; 6 teeth; 32 pitch; circular pitch 0.098 in., 500 in rack gear; 0.562 in. OD, 0.532 in. lg, 0.191 in. ID; straight face; Times Facsimile Corp, part/dwg No. 42-17-00-08.	Drive for shaft 0473.
0431	Std Navy: N16-S-21226-1135	SHAFT ASSEMBLY: consists of: 1 shaft, 1 gear, 2 mechanical ring retainers, and 1 pinion; over-all dim.; 2 19/32 in. lg, 1.533 in. dia; mtg data: two 0.1872 in. dia journals on opposite ends; pinion is fitted to gear; gear is pinned to shaft; Times Facsimile Corp, part/dwg No. 42-16-03-30.	Idler gear-shaft assembly in drum gear train.
0432	Std Navy: N16-G-432998-461	GEAR: spur; free machining yellow brass, smooth finish; straight teeth; 105 teeth, 14 1/2 deg pressure angle, 3/16 in. wide straight face; diametral pitch 60; 1.732 in. PD; dim.: 1.765 in. OD, 0.188 in. dia bore, 0.593 in. over-all wd; hub 0.375 in. lg, 7/16 in. dia w/0.085 in. w, 3/32 in. d slot in end; mtg data: slide fit on 3/16 shaft; Times Facsimile Corp, part/dwg No. 42-16-03-20.	Drum drive train gear.
0433	Std Navy: N16-S-21226-1121	SHAFT ASSEMBLY: consists of: 1 shaft, 1 gear, 1 AC motor rotor, 2 mechanical ring retainers; over-all dim.; 2 19/32 in. lg, 0.990 in. dia; mtg data: two 0.1870 in. dia journals; rotor is press fitted to shaft; gear is press fitted and pinned to shaft; Times Facsimile Corp, part/dwg No. 42-16-03-40.	Drum drive motor shaft ass'y.
0434	Std Navy: N16-G-435001-594	GEAR: dual spur; brass; teeth data; gear No. 1: straight teeth, 20 teeth, 14 1/2 deg pressure angle, 5/32 in. face, straight face; gear No 2: straight teeth, 60 teeth, 14 1/2 deg pressure angle, 3/16 in. face, straight face; 48 diametral pitch: gear No. 1 and gear No. 2-48; PD, gear 1: 0.458 in. OD, gear 2: 1.289 in. OD, 0.188 in. ID, 7/16 in. over-all width; no hub; composition bushing 0.189 in. ID, 0.253 in. OD, 7/16 in. lg press fitted into gear; Times Facsimile Corp, part/dwg No. 42-17-05-00.	Gear in threaded shaft 0465 gear train.

0435	Std Navy: N16-G-435002-402	GEAR: dual spur; brass; teeth data: gear 1: straight teeth, 40 teeth, pressure angle, 5/32 in. face, straight face, gear 2: straight teeth, 64 teeth, 14 1/2 deg pressure angle, 3/16 in. face, straight face; diametral pitch gear 1 and gear 2-48; PD: gear 1: 0.831 in. gear 2: 1.331 in.; dim.: gear 1: 0.873 in. OD, gear 2: 1.372 in. OD, 0.188 in. ID, 7/16 in. over-all wd; no hub; composition bushing 0.189 in. ID, 0.253 in. OD, 7/16 in. lg press-fitted into gear; Times Facsimile Corp, part/dwg No. 42-17-06-00.	Gear in threaded shaft 0465 gear train.
0436	Std Navy: N16-G-432095-416	GEAR: spur; brass; teeth data: straight teeth, 60 teeth, 14 1/2 deg pressure angle, 0.218 in. face, straight face; diametral pitch 48; PD 1.248 in.; dim.: 1.289 in. OD, 0.188 in. ID, 0.249 in. over-all wd; hub data: one 1/64 in. lg projection, 1 3/8 in. OD; composition bushing 0.189 in. ID, 0.253 in OD, 7/32 in. lg press-fitted into gear; Times Facsimile Corp, part/dwg No. 42-17-07-00.	Gear in threaded shaft 0465 gear train.
0437	Std Navy: N17-G-436547-444	GEAR, WORM: nylon base bakelite gear, brass hub; teeth data: RH helical teeth, 6 deg 57 min, 14 deg helix angle, 60 teeth, 14 deg pressure angle, 3/16 in. face width concave face; diametral pitch 41.275; PD 1.464 in.; dim.: 1.546 in. OD, 0.376 in. ID, 57/64 in. over-all wd; hub data: one projection 0.436 in. OD, 0.562 in. lg with shoulder 5/8 in. dia, 0.093 in. lg; two 1/32 in. wd axial slots on end of hub; one 1/32 in. wd traverse slot adjacent to shoulder; Times Facsimile Corp, part/dwg No. 42-16-01-40.	For speed reduction from 1800 rpm to 60 rpm.
0438	Std Navy: N42-R-2047-500	RETAINER, MECHANICAL: circular E shape; steel, zinc plated; dim.: 0.335 in. OD, 0.145 in. ID, 0.025 in. wd; Waldes Kohinoor No. 5133-18-ST-17.	Mechanical retainer.
0439	x	Same as 0438.	Mechanical retainer.
0440	x	Same as 0438.	Mechanical retainer.
0441	Std Navy: N17-R-651091-124	RETAINER, MECHANICAL: open ring-shaped; steel, zinc plated; dim.: 0.28 in. ID, 0.540 in. OD fully spread, 0.025 in. thick; Waldes Kohinoor No. 5100-31-ST-17.	Mechanical retainer on drum shaft 0487.
0442	Std Navy: N16-R-651091-103	RETAINER, MECHANICAL: open ring-shaped; steel; zinc plated; dim.: 0.225 in. ID, 0.450 in. OD fully spread, 0.025 in. thick; Waldes Kohinoor No. 5100-25-ST-17.	Mechanical retainer on drum shaft 0487.
0443	x	Same as 0442.	Mechanical retainer on B401.
0444	x	Same as 0442.	Mechanical retainer on 0465.
0445	x	Same as 0442.	Mechanical retainer on 0465.
0446	x	Same as 0442.	Mechanical retainer on 0465.
0447	Std Navy: N16-R-651091-102	RETAINER, MECHANICAL: open ring-shaped; beryllium copper, zinc plated; dim.: 0.168 in. ID, 0.298 in. OD fully spread, 0.015 in. thick; Waldes No. 5100-18-C-17.	Mechanical retainer on shaft assembly 0431.
0448	x	Same as 0447.	Mechanical retainer on shaft assembly 0431.
0449	x	Same as 0447.	Mechanical retainer on shaft assembly 0433.
0450	x	Same as 0447.	Mechanical retainer on shaft assembly 0433.

TABLE 8-4. TABLE OF REPLACEABLE PARTS—Cont.

REF. DESIG.	STOCK NUMBER: SIGNAL CORPS, STANDARD NAVY, AIR FORCE	NAME AND DESCRIPTION	LOCATING FUNCTION
0451	x	Same as 0447.	Mechanical retainer for gear 0435.
0452	x	Same as 0447.	Mechanical retainer for gear 0436.
0453	x	Same as 0447.	Mechanical retainer for gear 0434.
0454	x	Same as 0447.	Mechanical retainer on 0473.
0455	x	Same as 0447.	Mechanical retainer on 0473.
0456	x	Same as 0447.	Mechanical retainer on 0473.
0457	x	Same as 0447.	Mechanical retainer on 0473.
0458	Std Navy: N16-R-651091-226	RETAINER, MECHANICAL: open ring-shaped; steel, zinc plated; dim.: 0.338 in. ID, 0.618 in. OD fully spread, 0.025 in. thick; Waldes Kohinoor No. 5100-37-ST-17.	Mechanical retainer on drum shaft.
0459	Std Navy: N17-B-775001-183*	BUMPER: rubber, med grade; cylindrical shape; dim.: 5/16 in. dia, 9/16 in. lg; mtg dim.: 0.111 in. dia, axial hole 1/4 in. d; Times Facsimile Corp, part/dwg No. 42-16-01-14.	Absorbs shock of carriage return.
0460	Std Navy: N17-H-77691-1013	HOLDER, STYLUS: consists of: 1 pivoted stylus holder, 1 detent rod, 1 dampener rod, and 2 mechanical ring retainers; over-all dim.: 23/32 in. lg, 1 1/16 in. wd, 1/2 in. h; mtg data: two journals, one on ea end: one journal has 60 deg conical end; Times Facsimile Corp, part/dwg No. 42-03-02-20.	Holds stylus 0401.
0461	Std Navy: N16-C-159001-103	CARRIAGE SUBASSEMBLY: consists of: 1 bushing, 1 LH side plate and 1 RH side plate; over-all dim.: 1 31/32 in. lg, 3/4 in. wd, 7/8 in. h, 0.0002 in. thick; hard chrome finish inside bushing; 0.0005 in. thick nickel plate finish on both side plates; Times Facsimile Corp, part/dwg No. 42-03-01-00.	Guides stylus and carriage.
0462	Std Navy: N16-G-934761-102	GUIDE, PAPER: nylon base bakelite; flat rectangular shape; over-all dim.: 1 1/4 in. lg, 3/16 in. wd, 3/32 in. thick; one 0.093 in. dia mtg hole located on center line 3/32 in. from end; one sapphire rod 0.065 in. dia, 3/16 in. lg located transversely 1/16 in. from end opposite that of mtg hole; Times Facsimile Corp, part/dwg No. 42-03-03-10.	Guides recording paper.
0463	Std Navy: N17-C-98611-1072	COUPLING SECTION: consists of: 1 base plate, 1 latch, 2 helical extension springs, and 1 torsion spring; over-all dim.: 2 9/16 in. lg, 1 51/64 in. wd, 7/8 in. thick; mtg data: one 15/32 in. dia hole and one 3/32 in. wd curved slot approx 7/8 in. lg; 0.00025 in. thick copper flash and 0.0005 in. thick nickel plate finish on base plate; 0.00025 in. thick copper flash and 0.0005 in. thick hard chrome plate finish on latch; Times Facsimile Corp, part/dwg No. 42-08-04-00.	Couples drum to drive synchronizing mechanism.

0464	Std Navy: N16-D-905001-113	DRIVE SUBASSEMBLY: consists of: 1 hub, 1 key, 1 ring, 1 ratchet, 1 pawl and 1 adjustable stop bar; over-all dim.: 1 3/8 in. lg, 1 9/16 in. dia excluding stop bar and pawl; one 3/8 in. dia, 9/16 in. lg mtg hole; ratchet and pawl provide for unidirectional drive; Times Facsimile Corp, part/dwg No. 42-26-00-00.	Drive synchronizing mechanism.
0465	Std Navy: N16-S-21226-1136	SHAFT ASSEMBLY: type 303 stainless steel; 14 1/2 in. lg, 5/8 in. dia; ACME 29 deg LH, single thd, 10 thd per in.; Times Facsimile Corp, part/dwg No. 42-00-11-	Feeds carriage.
0466	x	Not used.	
0467	Std Navy: N16-C-125001-263	CAM: brass; "D" shaped; dim.: 1/2 in. dia, 3/16 in. thick; D hole in center, 3/16 in. dia 0.156 in. from flat; Times Facsimile Corp, part/dwg No. 42-00-00-05.	To actuate lever operating S6.
0468	Std Navy: N16-N-87874-1001	NUT, HALF: nylon, grade FM10001; 5/8 in. ACME 29 deg thd, LH, single thd, 10 thd per in.; .677 in. lg, 1 1/16 in. h, .244 in. thick overall; Times Facsimile Corp, part/dwg No. 42-00-00-07.	Engages in feed shaft.
0469	x	Not used.	
0470	x	Not used.	
0471	Std Navy: N38-B-855-20	BRUSH, BRISTLE: rectangular; 12 in. lg, 1 1/2 in. wd, 3/16 in. thick over-all; hair bristles crimped onto supporting member; Fuller Brush Co No. 8M1453-3-L; Times Facsimile Corp, part/dwg No. 42-00-03-01.	Holds recording paper against drum.
0472	x	Not used.	
0473	Std Navy: N16-S-21226-1146	SHAFT ASSEMBLY: stainless steel; 14 3/8 in. over-all lgth; one cam; journal shaft ends; Times Facsimile Corp, part/dwg 42-00-02-01.	Engages half nut.
0474	Std Navy: N16-H-78399-1001	HOLDER: aluminum; grey; holds brush by three leaf springs 5 in. apart in a row; has two slots 8 in. apart to allow two leaf springs on supporting surface to clamp holder; tray shaped; Times Facsimile Corp, part/dwg No. 42B-00-03-10.	Holds bristle brush and collects recording dust particles.
0475	Std Navy: N16-G-934761-103	GUIDE, PAPER: aluminum; grey; rectangular; 13 5/8 in. lg, 1 in. wd, 3/16 in. d; two 0.152 in. dia mtg holes spaced 13 5/16 in. C to C; contour of cross section has 3/8 in. straight portion, 3/8 in. portion bent 35 deg on one end from straight portion, and 3/16 in. portion bent 6 deg in opposite direction on the other end of the straight portion; Times Facsimile Corp, part/dwg No. 42B-00-00-09.	Guides recording paper into drum.
0476	Std Navy: N16-D-84032-6901	DRUM, FACSIMILE: aluminum; 12 1/2 in. lg, 6 in. dia over-all; supplementary parts consist of 5 clamping fingers, 1 coupler subassy, 1 clamping finger operating yoke, 1 drum slide locating plate, one 3/8 in. dia mtg hole located at each end to accommodate a 3/8 in. dia shaft; dynamically balanced; Times Facsimile Corp, part/dwg No. 42-08-00-00.	Supports recording paper.

* Not furnished as a maintenance part. If failure occurs, do not request replacement unless the item cannot be repaired or fabricated.

TABLE 8-4. TABLE OF REPLACEABLE PARTS—Cont.

REF. DESIG.	STOCK NUMBER: SIGNAL CORPS, STANDARD NAVY, AIR FORCE	NAME AND DESCRIPTION	LOCATING FUNCTION
0477	x	PLATE, COVER: consists of one ea "U" shaped aluminum plate, hinged door, and paper load actuator subassy and two ea captive thumb bolts and studs; 18 7/8 in lg, 7 59/64 in. h, 1 3/16 in. thick over-all excluding thumb bolts; four 0.180 in. dia mtg holes spaced 16 3/16 in. by 5 11/16 in. and two holes 15/64 in. dia spaced 5 11/16 in. C to C; grey painted finish; labeled RECORD, PAPER LOAD and LOCAL OPERATING PROCEDURE (with procedure); "U" shaped plate has two 4-40 tapped holes 9/32 in. apart at center of cross piece and two 4-40 tapped holes 3/8 in. apart at the bottom edge of ea leg; Times Facsimile Corp, part/dwg No. 42C-00-04-00.	Front plate for recorder subassembly.
0478	Std Navy: N16-S-21065-3825	SHAFT: brass; 0.0005 in. nickel plated finish; 3/16 in. dia; 13 9/16 in. over-all lgth; two journals ea 1/8 in. dia, by 1/8 in. lg, 2-56 NFT 3/8 in. lg, on one end; Times Facsimile Corp, part/dwg No. 42-00-00-06.	Trolley rod.
0481	Std Navy: N17-L-250842-551	LENS, INDICATING LIGHT: white, translucent, 1/2 in. dia, convex, glass lens, frosted back; 5/8 in. lg, 5/8 in. dia over-all; mtd in chrome plated aluminum holder; thd type mtg; thd dim.: 9/16 in. dia, No. 27 male thd, 3/16 in. lg; Dialco Inc. No. 81-115.	Lens for XE8 and XE9.
0482	Std Navy: N42-R-2052-3960	RING, RETAINER: ring shaped, steel; zinc plated; dim.: 0.450 in. OD, 0.250 in. ID, 0.010 in. thick; used to lock and position machine parts; has six equally spaced radial teeth on inside dia; general purpose; Waldes Kohinoor type No. 5105-25-ST-17-ZF.	Mechanical retainer in motor B401.
0483	x	Same as 0482.	Mechanical retainer in B401.
0484	x	Same as 0482.	Mechanical retainer in B401.
0485	Std Navy: N42-R-2047-174	RING, RETAINER: open ring-shaped; beryllium copper; zinc plated; dim.: 0.184 in. dia face OD, 0.112 in. dia face ID, 0.010 in. thick, 0.222 in. dia max OD spread; used to lock and position machine parts; has two 0.026 in. dia holes in lugs for spreading the retainer; general purpose; Waldes Kohinoor No. 5100-12-C-17-ZF.	Mechanical retainer in holder 0460.
0486	x	Same as 0485.	Mechanical retainer in holder 0460.
0487	x	SHAFT: stainless steel; cylindrical shape; annealed, cold drawn and centerless ground to size; 12 29/32 in. lg, 3/8 in. dia overall; two mtg journals, one end .3147 in. dia, other end .3150 in. dia, ea 9/32 in. lg; one end of shaft drilled and slotted and other end 1/8 in. spherical radius; has one keyway 1/16 in. wide; has 3 grooves for retainer rings; Times Facsimile Corp, part/dwg No. 42-00-09-01.	Supports drum 0476.
0488	x	CLIP, MECHANICAL: beryllium copper; 27/32 in. lg, 19/32 in. high, 1/2 in. wide overall; two mtg slotted holes, 9/32 in. C to C; S-shaped hook for catching action; Times Facsimile Corp, part/dwg No. 42C-00-00-33.	Catches and holds door knob.

0489	x	CHAIN: brass; nickel plated; ball shaped links; 1/8 in. overall dia; approx 32 lbs breaking strength; approx 0.13 lbs. per ft linear weight; 7 in. lg; Charles Brand No. 6 (1/8 in. dia ball) nickel plated beaded chain 7 in. lg; Times Facsimile Corp, part/dwg No. 42C-00-00-32.	Stop for drum shield 0490.
0490	x	SHIELD, DRUM: steel; semi-cylindrical shell with sides; 15 in. lg, 8 5/16 in. wide excel knob, 2 47/64 in. thick overall; mounted by means of two pivoted brackets; solder lug and chain holder attached to ea side; Times Facsimile Corp, part/dwg No. 42C-00-20-00.	Radiation shield for drum 0476.
0491	x	HOLDER, CHAIN: brass; nickel plated; holds end of beaded ball chain by means of socket; mounted to supporting surface by means of eyelet; mounting eyelet offset with respect to socket; Charles Brand Co. type A offset socket and ring coupling for No. 6 beaded chain; Times Facsimile Corp, part/dwg No. 42C-00-00-24.	Holder for chain 0489.
0492	x	Same as 0489.	Stop for drum shield 0490.
0493	x	Same as 0491.	Holder for chain 0492.
0494	x	CHAIN AND HOLDER ASSEMBLY: brass; nickel plated; consists of chain (ref desig 0489) and holder (ref desig 0491); 8 1/4 in. lg overall; mounted to supporting surface by means of eyelet; Times Facsimile Corp, part/dwg No. 42C-00-00-35.	Stop for drum shield 0490.
0495	x	Same as 0404, except consists of chain (ref desig 0492) and holder (ref desig 0493).	Stop for drum shield 0490.
0496		RING, RETAINER: "e" shaped; carbon spring steel; oil dipped; dim.: .437 in. OD, .025 in. thick; for .218 in. shaft; used to position machine parts; general purpose; Waldes Kohinoor No. X5133-21; TFC part/dwg. No. 42-00-00-26. (on serial nos. 388 and up).	Spacer in U4.
0497		RING, RETAINER: "e" shaped; carbon spring steel; oil dipped; dim.: .437 in. OD, .015 in. thick; for .218 in. shaft, used to position machine parts; general purpose; Waldes Kohinoor No. X5133-21, .015 in. thick; TFC part/dwg. No. 42-00-00-27. (on serial nos. 388 and up).	Spacer in U4.

TABLE 8–4. TABLE OF REPLACEABLE PARTS—Cont.

REF. DESIG.	STOCK NUMBER: SIGNAL CORPS, STANDARD NAVY, AIR FORCE	NAME AND DESCRIPTION	LOCATING FUNCTION
P1	Std Navy: N17-I-36480-5473	INSERT, ELECTRICAL CONNECTOR: high dielectric type; contact data: 15 round male contacts, 12 No. 20 contacts 1/4 in. lg, 3 No. 12 contacts 7/16 in. lg; 500 VAC, 5 amp for No. 20 contacts, 25 amp for No. 12 contacts; rectangular phenolic body; over-all dim.; 1 1/2 in. lg by 3/4 in. wd by 1 1/32 in. thick incl term. and contacts; two 1/8 in. dia mtg holes spaced 1 3/16 in. C to C; polarized; general purpose; US Tool Mfg Co No. 902M; Times Facsimile Corp, part/dwg No. 42-00-51-01.	On recorder subassy, connects to J1.
P2	x	Same as P1.	On amplifier-detector connects to J2.
P3	x	Same as P1.	On audio-frequency osc, connects to J3.
P4	x	Same as P1.	On amplifier-modulator, connects to J4.
P5	Std Navy: N17-C-71131-2960	CONNECTOR, PLUG: contact data: three contacts, female, one round and two curved; polarized; straight type; 1 21/32 in. lg, 1 5/32 in. dia; 15 amp, 125 v; not for RF; cylindrical bakelite body; 1/2 in. dia max cable opening; special "Twist-Lock" type contacts; Hubbell catalog No. 7484; Times Facsimile Corp, part/dwg No. 61-11-12-04.	On inter-connecting cable between cabinet and chassis.
P6	x	Same as P5.	On end of cable W1.

R1	Sig C: 3RC20BF623J Std Navy: N16-R-50533-431	RESISTOR, FIXED, COMPOSITION: 62,000 ohms plus or minus 5%, ½ W; AB No. EB6235; JAN Type No. RC20BF623J; JAN Spec No. R-11A.	Test meter multiplier resistor.
R2	x	RESISTOR, FIXED, COMPOSITION: ½ W; selected for meter to read "100" when set is under the following conditions: 117 VAC line, OFF-STANDBY etc., switch in SYNC position; DENSITY in TEST SIGNAL position (CIRCUIT TEST switch in any position). Listed for reference only.	Test meter multiplier resistor.
R3	Sig C: 3RC20BF124J Std Navy: N16-R-50650-0431	RESISTOR, FIXED, COMPOSITION: 120,000 ohms plus or minus 5%, ½ W; AB No. EB1245; JAN type No. RC20BF124J; JAN Spec No. R-11A.	Test meter multiplier resistor.
R4	x	RESISTOR, FIXED, COMPOSITION: ½ W; selected as R2 except CIRCUIT TEST switch in VR75 position. Push PUSH TO TEST switch. Listed for reference only.	Test meter multiplier resistor.
R5	Sig C: 3RC20BF134J Std Navy: N16-R-50659-0431	RESISTOR, FIXED, COMPOSITION: 130,000 ohms plus or minus 5%, ½ W; AB No. EB1345; JAN Type No. RC20BF134J; JAN Spec No. R-11A.	Test meter multiplier resistor.
R6	x	RESISTOR, FIXED, COMPOSITION: ½ W; selected as R2 except CIRCUIT TEST switch in 60 cyc position. Push PUSH TO TEST switch. Listed for reference only.	Test meter multiplier resistor.
R7	Sig C: 3RC20BF563J Std Navy: N16-R-50515-0431	RESISTOR, FIXED, COMPOSITION: 56,000 ohms plus or minus 5%, ½W; AB No. EB5635; JAN Type No. RC20BF563J; JAN Spec No. R-11A.	Test meter multiplier resistor.
R8	x	RESISTOR, FIXED, COMPOSITION: ½ W; selected as R2 except CIRCUIT TEST switch in OSC position. Push PUSH TO TEST switch. Listed for reference only.	Test meter multiplier resistor.
R9	Sig C: 3RC20BF474J Std Navy: N16-R-50821-0431	RESISTOR, FIXED, COMPOSITION: 470,000 ohms plus or minus 5%, ½ W; AB No. EB4745; JAN Type No. RC20BF474J; JAN Spec No. R-11A.	Test meter multiplier resistor.
R10	x	RESISTOR, FIXED, COMPOSITION: ½ W; selected as R2 except OFF-STANDBY etc. switch in RUN position. RECORD button depressed. CIRCUIT TEST switch in PRINT position. Push PUSH TO TEST switch. Listed for reference only.	Test meter multiplier resistor.
R11	Sig C: 3RC20BF273J Std Navy: N16-R-50398-0431	RESISTOR, FIXED, COMPOSITION: 27,000 ohms plus or minus 5%, ½ W; AB No. EB2735; JAN Type No. RC20BF273J; JAN Spec No. R-11A.	Test meter multiplier resistor.

TABLE 8–4. TABLE OF REPLACEABLE PARTS—Cont.

REF. DESIG.	STOCK NUMBER: SIGNAL CORPS, STANDARD NAVY, AIR FORCE	NAME AND DESCRIPTION	LOCATING FUNCTION
R12	x	RESISTOR, FIXED, COMPOSITION: ½ W; selected as R2 except CIRCUIT TEST switch in SYNC DRIVE position. Push PUSH TO TEST switch. Listed for reference only.	Test meter multiplier resistor.
R13	Sig C: 3RC20BF564J Std Navy: N16-R-50857-0431	RESISTOR, FIXED, COMPOSITION: 560,000 ohms plus or minus 5%, ½ W; AB No. EB5645; JAN Type No. RC20BF564J; JAN Spec No. R-11A.	Test meter multiplier resistor.
R14	x	RESISTOR, FIXED, COMPOSITION: ½ W; selected as R2 except CIRCUIT TEST switch in HI B plus position. Push PUSH TO TEST. Listed for reference only.	Test meter multiplier resistor.
R15	Sig C: 3RC20BF184J Std Navy: N16-R-50695-0431	RESISTOR, FIXED, COMPOSITION: 180,000 ohms plus or minus 5%, ½ W; AB No. EB1845; JAN Type No. RC20BF184J; JAN Spec No. R-11A.	Test meter multiplier resistor.
R16	x	RESISTOR, FIXED, COMPOSITION: ½ W; selected as R2 except CIRCUIT TEST switch in LO B plus position. Push PUSH TO TEST switch. Listed for reference only.	Test meter multiplier resistor.
R19	Sig C: 3RC20BF113J Std Navy: N16-R-50299-0431	RESISTOR, FIXED, COMPOSITION: 11,000 ohms plus or minus 5%, ½ W; AB No. EB1135; JAN Type No. RC20BF113J; JAN Spec No. R-11A.	Test meter multiplier resistor.
R20	x	RESISTOR, FIXED, COMPOSITION: ½ W; selected as R2 except CIRCUIT TEST switch in SIG AMP OUT position. Push PUSH TO TEST switch. Listed for reference only.	Test meter multiplier resistor.
R21	x	Same as R15.	Test meter multiplier resistor.
R22	x	RESISTOR, FIXED, COMPOSITION: ½ W; selected as R2 except CIRCUIT TEST switch in POWER position. Push PUSH TO TEST switch. Listed for reference only.	Test meter multiplier resistor.
R23	Std Navy: N16-R-65882-7901	RESISTOR, FIXED, WIRE WOUND: 500 ohms plus or minus 5%; 12 W; WL JAN Type No. RW32G501; JAN Spec No. R-26A.	High B plus filter.
R24	x	Same as R23.	Low B plus filter.
R25	Std Navy: N16-R-66048-6926	RESISTOR, FIXED WIRE WOUND: 1,200 ohms plus or minus 5%, 12 W; WL JAN Type No. RW32G122; JAN Spec No. R-26A.	Low B plus filter.
R27	Std Navy: N16-R-65430-8796	RESISTOR, FIXED, WIRE WOUND: 25 ohms plus or minus 5%, 12 W; WL JAN Type No. RW32G250; JAN Spec No. R-26A.	Charging current limiter high B plus.
R28	Sig C: 3RC40BF154K Std Navy: N16-R-50679-0551	RESISTOR, FIXED, COMPOSITION: 150,000 ohms plus or minus 10%, 2 W; AB Type No. HB1541; JAN Type No. RC40BF154K; JAN Spec No. R-11A.	High B plus bleeder.

R29	x	Same as R28.	High B plus bleeder.
R30	Sig C: 3RC40BF103K Std Navy: N16-R-50283-0551	RESISTOR, FIXED, COMPOSITION: 10,000 ohms plus or minus 10%, 2 W; AB Type No. HB1031; JAN Type No. RC40BF103K; JAN Spec No. R-11A.	Voltage dropping for actuator E403.
R31	Sig C: 3RC20BF103K Std Navy: N16-R-50282-0811	RESISTOR, FIXED, COMPOSITION: 10,000 ohms plus or minus 10%, ½ W; AB Type No. EB1031; JAN Type No. RC20BF103K; JAN Spec No. R-11A.	Low B plus filter resistor.
R32	Sig C: 3RC30BF472K Std Navy: N16-R-50130-0231	RESISTOR, FIXED, COMPOSITION: 4700 ohms plus or minus 10%, 1 W; AB Type No. GB4721; JAN Type No. RC30BF472K; JAN Spec No. R-11A.	Low B plus filter resistor.
R33	Sig C: 3RC20BF223K Std Navy: N16-R-50372-0811	RESISTOR, FIXED, COMPOSITION: 22,000 ohms plus or minus 10%, ½ W; AB Type No. EB2231; JAN Type No. RC20BF223K; JAN Spec No. R-11A.	Load for filter Z1.
R34	Sig C: 3RC30BF101J Std Navy: N16-R-49579-0751	RESISTOR, FIXED, COMPOSITION: 100 ohms plus or minus 5%, 1 W; JAN Type No. RC30BF101J; JAN Spec No. R-11A.	Cathode resistor of V2 and V3.
R35	Sig C: 3RC20BF105K Std Navy: N16-R-50975-0811	RESISTOR, FIXED, COMPOSITION: 1 meg plus or minus 10%, ½ W; AB Type No. EB1051; JAN Type No. RC20BF105K; JAN Spec No. R-11A.	Voltage divider on output of limiter V302.
R36	Sig C: 3RC20BF474K Std Navy: N16-R-50822-0811	RESISTOR, FIXED, COMPOSITION: 470,000 ohms plus or minus 10%, ½ W; AB Type No. EB4741; JAN Type No. RC20BF474K; JAN Spec No. R-11A.	Provides D-C path B— to ground.
R37	x	Same as R35.	Voltage divider on grid of V1A.
R38	Std Navy: N16-R-91564-9960	RESISTOR, VARIABLE: resistance element: combination fixed composition and wire wound resistors; resistance data: one sect, 50,000 ohms plus or minus 5%; nominal power rating 3 W; four solder lug term.; phenolic cylindrical case; body dim.: 1¾ in. dia by 1⅞ in. lg; ¼ in. dia by ⅞ in. lg high torque shaft; contact arm: insulated, 30 positions, continuous rotation; ⅜ in. lg from mtg surface; nonturning stud located on 17/32 in. radius on mtg surface; Times Facsimile Corp, part/dwg No. 41-40-00-06.	Density control.
R39	Sig C: 3RC20BF102K Std Navy: N16-R-49922-0811	RESISTOR, FIXED, COMPOSITION: 1,000 ohms plus or minus 10%, ½ W; AB Type No. EB1021; JAN Type No. RC20BF102K; JAN Spec No. R-11A.	Part of voltage divider on output of limiter V302.
R40	Sig C: 3RC30BF473K Std Navy: N16-R-50481-0231	RESISTOR, FIXED, COMPOSITION: 47,000 ohms plus or minus 10%, 1 W; AB Type No. GB4731; JAN Type No. RC30BF473K; JAN Spec No. R-11A.	Charge resistor for C7B.

TABLE 8–4. TABLE OF REPLACEABLE PARTS—Cont.

REF. DESIG.	STOCK NUMBER: SIGNAL CORPS, STANDARD NAVY, AIR FORCE	NAME AND DESCRIPTION	LOCATING FUNCTION
R41	Std Navy: N16-R-91031-2985	RESISTOR, VARIABLE: wire wound element; one sect 5000 ohms plus or minus 10%, 3 W nominal power rating; taper data: std A taper, MBCA Ref dwg group 3; three solder lug term.; enclosed bakelite body, $1\frac{21}{32}$ in. dia by $\frac{25}{32}$ in. d; $\frac{1}{4}$ in. dia by $\frac{7}{8}$ in. lg normal torque shaft, contact arm insulated from case, no OFF position; mtg data: bushing mtd, $\frac{3}{8}$ in. dia, 32 thd per in., $\frac{3}{8}$ in. lg; nonturning device on $\frac{17}{32}$ in. radius at 9 o'clock; general purpose; Clarostat No. 58-5,000; Times Facsimile Corp, part/dwg No. 41C-20-03-01.	Sync ma control.
R42	Sig C: 3RC20BF104K Std Navy: N16-R-50633-0811	RESISTOR, FIXED, COMPOSITION: 100,000 ohms plus or minus 10%, $\frac{1}{2}$ W; AB Type No. EB1041; JAN Type No. RC20BF104K; JAN Spec No. R-11A.	Grid resistor V1A.
R43	Std Navy: N16-R-49769-0811	RESISTOR, FIXED, COMPOSITION: 470 ohms plus or minus 10%, $\frac{1}{2}$ W; JAN Type No. RC20BF471K; JAN Spec No. R-11A.	Cathode resistor V1B.
R44	x	Same as R30.	Voltage dropping resistor for E403.
R45	Sig C: 3RC20BF473K Std Navy: N16-R-50480-0811	RESISTOR, FIXED, COMPOSITION: 47,000 ohms plus or minus 10%, $\frac{1}{2}$ W; AB Type No. EB4731; JAN Type No. RC20BF473K; JAN Spec No. R-11A.	Part of voltage divider on output of limiter V302.
R46	x	Same as R45.	Grid resistor V4.
R47	Sig C: 3RC20BF274K Std Navy: N16-R-50741-0811	RESISTOR, FIXED, COMPOSITION: 270,000 ohms plus or minus 10%, $\frac{1}{2}$ W; AB Type No. EB2741; JAN Type No. RC20BF274K; JAN Spec No. R-11A.	Current limiter for E1.
R48	x	Same as R47.	Current limiter for E2.
R49	x	Same as R47.	Current limiter for E3.
R50	x	Same as R47.	Current limiter for E4.
R51	x	Same as R15.	Part of voltage divider across V6.
R52	x	Same as R47.	Part of voltage divider across V6.
R53	x	Same as R15.	Part of voltage divider across V7.
R54	x	Same as R47.	Part of voltage divider across V7.
R55	Sig C: 3RC20BF682J Std Navy: N16-R-50200-0431	RESISTOR, FIXED, COMPOSITION: 6,800 ohms plus or minus 5%, $\frac{1}{2}$ W; JAN Type No. RC20BF682J; JAN Spec No. R-11A.	Test meter multiplier resistor.

R101	x	Same as R47.	Grid resistor V101B.
R102	x	Same as R47.	Grid resistor V102B.
R103	Sig C: 3RC20BF470K Std Navy: N16-R-49427-0811	RESISTOR, FIXED, COMPOSITION: 47 ohms plus or minus 10%, ½ W; AB Type No. EB4701; JAN Type No. RC20BF470K; JAN Spec No. R-11A.	Cathode resistor V102A.
R104	Sig C: 3RC20BF222K Std Navy: N16-R-50012-0811	RESISTOR, FIXED, COMPOSITION: 2200 ohms plus or minus 10%, ½ W; AB Type No. EB2221; JAN Type No. RC20BF222K; JAN Spec No. R-11A.	Cathode resistor V102B.
R105	Sig C: 3RC20BF101K Std Navy: N16-R-49580-0811	RESISTOR, FIXED, COMPOSITION: 100 ohms plus or minus 10%, ½ W; JAN Type No. RC20BF101K; JAN Spec No. R-11A.	Feedback resistor.
R106	x	Same as R42.	Plate load resistor for V102A.
R107	x	Same as R104.	Cathode resistor for V102B.
R108	x	Same as R42.	Plate load for V102B.
R109	x	Same as R31.	Voltage dropping resistor.
R110	x	Same as R47.	Current limiter for E102.
R111	x	Same as R47.	Current limiter for E101.
R112	x	Same as R47.	Current limiter for E103.
R201	x	Same as R36.	Plate load, V202B.
R202	x	Same as R47.	Voltage divider.
R203	Sig C: 3RC40BF683K Std Navy: N16-R-50553-0551	RESISTOR, FIXED, COMPOSITION: 68,000 ohms plus or minus 10%, 2 W; AB Type No. HB6831; JAN Type No. RC40BF683K; JAN Spec No. R-11A.	Cathode resistor V203.
R204	x	Same as R43.	Resistor in cathode of V202A.
R205	x	Same as R35.	Grid resistor V203.
R206	x	Same as R42.	Grid resistor V201A.
R207	x	Same as R104.	Cathode resistor V201A.
R208	x	Same as R47.	Grid resistor V201B.
R209	x	Same as R45.	Plate load V201B.

TABLE 8-4. TABLE OF REPLACEABLE PARTS—Cont.

REF. DESIG.	STOCK NUMBER: SIGNAL CORPS, STANDARD NAVY, AIR FORCE	NAME AND DESCRIPTION	LOCATING FUNCTION
R210	x	Same as R45.	V201B feedback resistor.
R211	Sig C: 3RC20BF153K Std Navy: N16-R-50336-0811	RESISTOR, FIXED, COMPOSITION: 15,000 ohms plus or minus 10%, ½ W; AB Type No. EB1531; JAN Type No. RC20BF153K; JAN Spec No. R-11A.	Part bias voltage divider for V202A.
R212	x	Same as R36.	Part voltage divider on V202A grid.
R213	Sig C: 3RC20BF185K Std Navy: N16-R-51038-0811	RESISTOR, FIXED, COMPOSITION: 1.8 meg plus or minus 10%, ½ W; AB Type No. ED1851; JAN Type No. RC20BF185K; JAN Spec No. R-11A.	Part of voltage divider of V202A.
R214	x	Same as R47.	Part of voltage divider on output of V201B.
R215	Sig C: 3RC20BF394K Std Navy: N16-R-50786-0811	RESISTOR, FIXED, COMPOSITION: 390,000 ohms plus or minus 10%, ½ W; AB Type No. EB3941; JAN Type No. RC20BF394K; JAN Spec No. R-11A.	Part of voltage divider on grid of V202A.
R216	Sig C: 3RC20BF472K Std Navy: N16-R-50129-0811	RESISTOR, FIXED, COMPOSITION: 4700 ohms plus or minus 10%, ½ W; AB Type No. EB4721; JAN Type No. RC20BF472K; JAN Spec No. R-11A.	Grid leak resistor on V202B.
R217	x	Same as R42.	Grid leak bias resistor for V202B.
R218	x	Same as R31.	Grid current limiter for V202B.
R219	x	Same as R47.	Current limiter for E201.
R220	x	Same as R47.	Current limiter for E202.
R221	x	Same as R47.	Current limiter for E203.
R222	Std Navy: N16-R-90835-6027	RESISTOR, VARIABLE: wire wound; rotating brush type; resistance and tolerance data: one sect, 2000 ohms plus or minus 10% tolerance; 2 W nominal; std A taper MBCA Ref Dwg Group 3; three solder lug term.; case data: enclosed molded bakelite case, 1⅛ in. dia, 9/16 in. d; ¼ in. dia round metal shaft ⅞ in. lg from mtg surface, normal torque; ins contact arm, no OFF position; mtg data: one ⅜ in. dia, 32 threads per in. bushing, ⅜ in. lg; nonturning device located on 9/16 in. radius at 9 o'clock; 1/16 in. by 3/64 in. wd slot on shaft end; Clarostat Mfg Co Type No. 43-2000 with ¼ in. dia shaft ½ in. lg projecting beyond mtg bushing with std screw driver slot; general purpose; Times Facsimile Corp, part/dwg No. 41B-14-01-06.	Bias control V202A.

R301	x	Same as R104.	Cathode resistor V302.
R302	x	Same as R42.	Grid resistor V302.
R303	x	Same as R42.	Plate load V302.
R304	x	Same as R47.	Screen resistor V302.
R305	x	Same as R42.	Plate load V301A.
R306	x	Same as R45.	Plate load V301B.
R307	x	Same as R47.	Isolation output V302.
R308	x	Same as R42.	Part of voltage divider for V301B grid.
R309	x	Same as R45.	Part of voltage divider V301B grid.
R310	x	Same as R42.	Grid current limiter for V301.
R311	x	Same as R104.	Cathode bias, V301.
R312	Std Navy: N16-R-91373-3010	RESISTOR, VARIABLE: wire wound element; one sect, 20,000 ohms plus or minus 10%; 3 W nominal power rating; taper data: std A taper, MBCA Ref Dwg Group 3; three solder lug term.; enclosed bakelite body, $1\frac{21}{32}$ in. dia by $\frac{25}{32}$ in. d; shaft data: round metal shaft, $\frac{1}{4}$ in. dia, $\frac{7}{8}$ in. lg from mtg surface, normal torque; contact arm ins from case, no OFF position; mtg data: bushing mtd, $\frac{3}{8}$ in lg; nonturning device on $\frac{17}{32}$ in. radius at 9 o'clock; general purpose; Clarostat No. 58-20,000; Times Facsimile Corp, part/dwg No. 41-05-01-31.	Frequency vernier control.
R313	x	Same as R47.	Current limiter E301.
R314	x	Same as R47.	Current limiter for E302.
R401	Sig C: 3RC40BF222K Std Navy: N16-R-50013-0551	RESISTOR, FIXED, COMPOSITION: 2200 ohms plus or minus 10%, 2 W; AB No. HB2221; JAN Type No. RC40BF222K; JAN Spec No. R-11-A.	Filter resistor in V4.
S1	Std Navy: N17-S-66104-8325	SWITCH, ROTARY: three sections; five positions max, adj stop incl; non "Pile-Up"; two poles, ten stator contacts per sect; two sect shorting type, one sect nonshorting type contacts; steatite sect; approx over-all dim.: $2\frac{3}{8}$ in. by $2\frac{1}{8}$ in. by $1\frac{3}{4}$ in.; one mtg bushing $\frac{3}{8}$-32 thd per in., $\frac{3}{8}$ in. lg; round shaft $\frac{7}{8}$ in. lg by $\frac{1}{4}$ in. dia; solder lug term.; general purpose; Times Facsimile Corp, part/dwg No. 41-40-01-00.	OFF-STANDBY-START-SYNC-RUN switch.
S2	Std Navy: N17-S-58902-4335	SWITCH, PUSH: two rotary positions; position one, two form A contacts; position two, one form A contact and one form A contact continuously closed; approx over-all dim.: $2\frac{1}{8}$ in. by $1\frac{3}{4}$ in. by $\frac{3}{4}$ in.; plunger with knob $1\frac{1}{2}$ in. lg. over-all; four solder lug term.; $\frac{3}{8}$ in. dia 32 thd mtg bushing, $\frac{3}{8}$ in. lg from mtg surface; Times Facsimile Corp, part/dwg No. 41-40-03-00.	PHASE switch.

TABLE 8–4. TABLE OF REPLACEABLE PARTS–Cont.

REF. DESIG.	STOCK NUMBER: SIGNAL CORPS, STANDARD NAVY, AIR FORCE	NAME AND DESCRIPTION	LOCATING FUNCTION
S3	Std Navy: N17-S-58883-1901	SWITCH, PUSH: SPDT; momentary; approx over-all dim.: 2 in. by 1 5/16 in. by 7/8 in.; plunger with bakelite knob, 1 1/8 in. lg over-all; four solder lug term. at rear; one mtg bushing 3/8-32 thd, 3/8 in. lg from mtg surface; general purpose; Mallory Type No. 2003; Times Facsimile Corp, part/dwg No. 41-42-00-02.	PRESS TO TEST switch.
S4	Std Navy: N17-S-60618-4463	SWITCH, ROTARY: one sect; 12 positions max; single pole; metal body; approx over-all dim.: 1 3/4 in. lg by 1 1/4 in. dia; one 3/8-32 thd per in. mtg bushing 3/8 in. lg from mtg surface; round shaft, 1 in. lg by 1/4 in. dia; solder lug term.; nonshorting; general purpose; Times Facsimile Corp, part/dwg No. 41-42-00-01.	CIRCUIT TEST switch.
S6	Std Navy: N17-S-68755-3224	SWITCH, SENSITIVE: 1A1B contact arrangement, one unit, two circuits, one normally open, one normally closed; AC and DC, 10 amp; 230 v; 8 oz oper pressure, 0.59 in. max pre-travel, 0.020 in max differential travel, 0.010 in. min overtravel; phenolic body; 1 1/4 in. lg 1/2 in. wd, 1/2 in. h over-all excluding term. and actuator; phenolic resin button external actuator, 19/64 in. lg; four solder lug term., two at ea end; two 3/32 in. dia mtg holes spaced 19/32 in. C to C; silver contact tips; GE type CR1070-C103C3; Times Facsimile Corp, part/dwg No. 42-17-00-01.	RECORD switch.
S7	x	Same as S6.	Carriage release switch.
S8	x	Same as S6.	Signal transfer switch.
T1	Std Navy: N17-T-61540-6915	TRANSFORMER, AUDIO FREQUENCY: line type; 250 ohms impedance split primary, 12,500 ohms impedance secondary; HS steel case; silicon-steel core lamination; over-all dim.; excluding mtg studs and term. 1 5/8 in. lg, 1 7/16 in. wd, 2 1/8 in. h; max oper power level 20 db; turns ratio 10:1 secondary to half primary; seven solder lug term. all located on same end as mtg studs; two No. 6-32 mtg studs, 1 5/32 in. lg, spaced 1 15/32 in. between centers; varnish impr and filled with Mitchell Rand battery seal; incl static shield; Times Facsimile Corp, part/dwg No. 41B-11-06-00.	Input transformer.
T2	Std Navy: N17-T-64545-1416	TRANSFORMER, AUDIO FREQUENCY: plate coupling type; 5000 ohms impedance primary, 16,000 ohms impedance secondary; HS steel case; silicon-steel laminated core; over-all dim., excluding mtg studs and term.: 2 7/16 in. lg by 2 in. wd by 3 3/8 in. h; max oper power level 10 W; four solder lug term. all located on same side as mtg studs; four no. 8-32 mtg studs 1/2 in. lg spaced on 2 1/32 in. by 1 9/16 in. mtg centers; varnish impr and filled with Mitchell Rand battery seal; Times Facsimile Corp, part/dwg No. 41B-11-02-00.	Stylus output.
T3	Std Navy: N17-T-64538-6426	TRANSFORMER, AUDIO FREQUENCY: plate coupling type; 5000 ohms impedance primary, 900 ohms impedance secondary; HS steel case; silicon-steel core; over-all dim. excluding mtg studs and term.: 1 5/8 in. lg, 1 3/8 in. wd, 1 7/8 in. h; four solder lug term. all located on same side as mtg studs, 7/16 in. lg spaced 1 15/32 in. C to C; varnish impr and filled with Mitchell Rand battery seal; Times Facsimile Corp, part/dwg No. 41B-11-01-00.	V4 driver.

T4	Std Navy: N17-T-64535-9291	TRANSFORMER, AUDIO FREQUENCY: plate coupling type; 5000 ohms impedance primary, 500 ohms impedance secondary; HS steel case; silicon-steel core; over-all dim. excluding mtg studs and term.: 1 5/8 in. lg, 1 7/16 in. wd, 2 1/8 in. h; four solder lug term. all located on same side as mtg studs, 15/32 in. lg, spaced 1 15/32 in. C to C; varnish impr filled with Mitchell Rand battery seal; Times Facsimile Corp, part/dwg No. 41B-11-03-00.	V2, V3 driver.
T101	Std Navy: N17-T-64540-3647	TRANSFORMER, AUDIO FREQUENCY: plate coupling type; 5000 ohms impedance primary, 6800 ohms impedance secondary; HS case; silicon-steel core; over-all dim. excluding mtg studs and term. 1 5/8 in. lg, 1 7/16 in. wd, 2 1/8 in. h; six solder lug term. all on same side as mtg studs; two No. 6-32 mtg studs 15/32 in. lg, spaced 1 15/32 in. C to C; varnish impr and filled with Mitchell Rand battery seal; Times Facsimile Corp, part/dwg No. 41B-11-00-00.	V102 input.
TB1	Std Navy: N17-B-78277-5555*	TERMINAL BOARD: consists of paper base bakelite board and 41 solder lug term.; 6 1/8 in. lg, 1 7/8 in. wd, 3/8 in. thick over-all; two 0.128 in. dia mtg holes spaced 5 7/8 in. C to C; wp; labeled R1 through R22 and C1 through C4; Times Facsimile Corp, part/dwg No. 41-42-01-00.	Mounts resistors and capacitors in U5.
TB2	Std Navy: N17-B-77535-4873*	TERMINAL BOARD: consists of 1 paper base bakelite board and 2 solder lug term.; 1 3/4 in. lg, 1 3/4 in. wd, 5/8 in. thick over-all; two 5/16 in. dia mtg holes spaced 1 in. C to C; wp; labeled CR5, CR6, CR7, CR8; Times Facsimile Corp, part/dwg No. 41-00-51-00.	Mounts CR5, CR6, CR7 and CR8.
TB3	Std Navy: N17-B-77690-5169*	TERMINAL BOARD: molded bakelite; incl five double screw type term.; barrier type; over-all dim.: 3 26/32 in. lg, 1 5/16 in. wd, 5/8 in. h; four 0.209 in. dia mtg holes on 3 3/8 in. by 1/2 in. centers; term. and screws are nickel-plated brass; Jones HB catalog No. 5-142; general purpose; Times Facsimile Corp, part/dwg No. 40-00-00-02.	Terminal board mounting plate A1.
TB101	Std Navy: N17-B-78177-4886*	TERMINAL BOARD: consists of 1 paper base bakelite board and 24 solder lug term. 3 5/32 in. lg, 2 1/2 in. wd, 3/8 in. thick over-all; two 0.128 dia mtg holes spaced 2 27/32 in. C to C; wp; labeled R101 through R109, C101, C102 and C104; Times Facsimile Corp, part/dwg No. 41-13-02-10.	Mounts resistor and capacitor in U2.
TB201	Std Navy: N17-B-78322-2461*	TERMINAL BOARD: consists of 1 paper base bakelite board and 50 solder lug term.; 4 1/8 in. lg, 3 in. wd, 3/8 in. thick over-all two 0.128 in. dia mtg holes spaced 3 13/16 in. C to C; wp; labeled R201 through R218, C201 through C205, and CR201; Times Facsimile Corp, part/dwg No. 41-14-02-10.	Mounts resistor and capacitors in U3.
TB301	Std Navy: N17-B-78222-3251*	TERMINAL BOARD: consists of 1 paper base bakelite board, 30 solder lug term. and 2 No. 6-32 clinch nuts; 5 1/8 in. lg, 3 1/2 in. wd, 9/16 in. thick over-all; two 0.128 dia mtg holes spaced 4 13/16 in. C to C; wp; labeled R301 through R311 and C301 through C305; Times Facsimile Corp, part/dwg No. 41-05-02-10.	Mounts resistors and capacitors in U1.
U1	Std Navy: F16-O-45640-2357*	OSCILLATOR, AF: consists of one removable box cover (incl two electron tube sockets XV301 and XV302, one variable resistor R312 and one resistor-capacitor assy board), one box (incl one tuning fork I301 and one male electrical connector insert P3) and two electron tubes V301 and V302; over-all dim.: 7 1/2 in. lg, 2 1/8 in. wd, 7 3/4 in. h; plug-in type of chassis mtd by means of two Camloc Fastener Corp catalog No. 2600-7 fasteners spaced approx 7 in. C to C and positioned by means of four 1/2 in. lg 1/4 in. dia locating pins; labeled FORK AMP; glow lamp indicators for open electron tube fil; Times Facsimile Corp, part/dwg No. 41-B-05-00-00.	Generates 1800 cps signal high stability.

* Not furnished as a maintenance part. If failure occurs, do not request replacement unless the item cannot be repaired or fabricated.

TABLE 8–4. TABLE OF REPLACEABLE PARTS—Cont.

REF. DESIG.	STOCK NUMBER: SIGNAL CORPS, STANDARD NAVY, AIR FORCE	NAME AND DESCRIPTION	LOCATING FUNCTION
U2	Std Navy: F16-A-39348-1010	AMPLIFIER-DETECTOR: consists of one removable box cover (incl three electron tube sockets XV101, XV102 and XV103, one 2-term. board E104, one resistor capacitor assy board and one transf T101) one box (incl one male electrical connector insert P2) and three electron tubes V101, V102 and V103; over-all dim.: 7½ in. lg, 2¾ in. wd, 7¼ in. h; plug-in type chassis mtd by means of two Camloc Fastener Corp No. 2600-7 fasteners spaced 7 in. C to C and positioned by means of five ½ in lg, ¼ in. dia locating pins; labeled SIG AMP; glow lamp indicators for open electron tube fil; Times Facsimile Corp, part/dwg No. 41C-13-00-00.	Amplifies and detects AM audiofrequency signals.
U3	Std Navy: F16-A-39374-1007	AMPLIFIER-MODULATOR: consists of one removable box cover (incl one 7-pin miniature electron tube socket XV203, two octal electron tube sockets XV201, XV202), one resistor-capacitor assy board, two bathtub capacitors C207, C208, one reactor L201, one phase shift network Z201 and one variable resistor R222), one box (incl one male electrical connector insert P4) and three electron tubes V201, V202 and V203; over-all dim.: 7½ in. lg, 3 in. wide, 7¾ in. high; plug-in type chassis by means of two Camloc Fastener Corp catalog No. 2600-7; fasteners spaced approx 7 in. C to C and positioned by means of five ½ in. lg, ¼ in. dia locating pins; labeled REMODULATOP; glow lamp indicators for open electron tube fil; Times Facsimile Corp, part/dwg No. 41C-14-00-00.	Provides 15kc AM signal; provides pulse signal for electromagnetic actuator.
U4	Std Navy: F16-R-40501-1008	RECORDER SUBASSEMBLY: consists of one drum 0476, one leadscrew shaft 0465, two gear boxes, one ea side, (first gear box incl two gear trains, one a-c sync motor B401 and one synchronizing mechanism 0464, second gear box incl one gear train, one cam rod actuator mechanism with a RECORD button and three push switches S6 through S8), one stylus holder mechanism 0461, one paper loading mechanism, one removable dust pan with brush, one male electrical connector insert P1 and one hinged drum shield (perforated) 0490 for RF shielding; over-all dim.: 18⅞ in. lg, 7 21/32 in. high with RF shield in closed position, 13 11/16 in. high with RF shield in open position, 9 7/16 in. wide; plug-in type unit mtd by means of two Times Facsimile Corp, part/dwg No. 42-00-01-04 captive screws spaced 15 in. C to C and two No. 10-32 NCT per in. tapped holes spaced 14 7/16 in. C to C and positioned by means of four ½ in. lg by ¼ in. dia locating pins; labeled RECORD, PAPER LOAD and contains oper and precaution instructions; Times Facsimile Corp, part/dwg No. 42C-00-00-00.	Provides mechanical motions for stylus recording of facsimile signals on paper.
U5	Std Navy: F16-A-39401-1005	AMPLIFIER-POWER SUPPLY SUBASSY: consists of one front panel (incl one meter M1, one variable stepping resistor R38, two rotary switches S1 and S4, 2 push switches S2 and S3, three fuses F1 through F3 and two glow lamp indicators E8 and E9), four electron tubes V1 through V4, one voltage regulator tube V5, two thermal resistor tubes V6 and V7, four plug-in capacitors C5 thru C8, four female electrical connector inserts J1 through J4, one 4-prong electron tube socket XV7, ten octal electron tube sockets XC5 through XC8 and XV1 through XV6, one filter Z1, four transformers T1 through T4, two female receptacle connectors J5 and J6, one variable resistor R41, four metallic selenium rectifiers CR1 through CR4, two armature relays K1 and K2, one resistor-capacitor assy board, three fixed paper	Provides power and functional control for all plug-in subassemblies.

		dielectric capacitors C9, C10 and C13, three fixed mica dielectric capacitors, C11, C12 and C14, four wire wound fixed power resistors R23 through R25 and R27, one electrical noise suppressor Z2, one male receptacle connector J7 and one bottom cover; over-all dim.: 18⅞ in. lg, 15 in. wide, 11⅜ in. high; mtg data: two angle bkt guides A3, one on ea side, for sliding into cabinet A2, two front panel captive screws H8 and H9; meter set circuit for operational and functional checks; glow lamp fil indicators for open electron tube fil; Times Facsimile Corp, part/dwg No. 41C-20-00-00.	
V1	Sig C: 2J6SN7 Std Navy: N16-T-56682	ELECTRON TUBE: twin triode; receiving tube; general purpose; Sylvania Prod; JAN Type No. 6SN7.	Motor driver and meter amplifier.
V2	Sig C: 2J1635 Std Navy: N16-T-71350	ELECTRON TUBE: twin triode; class B amplifier; general purpose; RCA; JAN Type No. 1635.	Motor power amplifier.
V3	x	Same as V2.	Motor power amplifier.
V4	x	Same as V2.	Print power amplifier.
V5	Sig C: 2J0A3 Std Navy: N16-T-53030	ELECTRON TUBE: Gaseous diode; voltage regulator, glow discharge type; general purpose; RCA; JAN Type No. 0A3.	Voltage regulator.
V6	Std Navy: N16-R-85006-1525	RESISTOR, THERMAL: 100 ohms nominal resistance at 25 v, 20 deg C ambient temp; 0.25 to 0.27 amp nom oper current, 9.1 W; 50 v max oper voltage, 25 to 50 v working range; AC or DC; ballast tube type, RMA No. ST-14 bulb, 4 1/16 in. over-all lgth of bulb and base excluding pins; 7-pin octal base; general purpose; Amperite No. 2H20.	Motor current regulation.
V7	Std Navy: N16-R-85003-2396	RESISTOR, THERMAL: 43.1 ohms nominal resistance at 25 v, 20 deg C ambient temp; 0.58 to 0.66 amp nom oper current, 24 W; 55 v max oper voltage, 25 to 55 v working range; AC or DC; ballast tube type, RMA ST16 bulb, 4¾ in. over-all lgth of bulb and base excluding pins; 4-prong base for socket mtg; has starting resistor; general purpose; Amperite No. 6-36.	Fil current regulator.
V101	x	Same as V1.	Amplifier/cathode follower.
V102	Sig C: 2J6SL7GT Std Navy: N16-T-56677	ELECTRON TUBE: twin triode; high-mu; receiving tube; general purpose; Sylvania Prod; JAN Type No. 6SL7GT.	Amplifier.
V103	x	Same as V101.	Detector rectifier.
V201	x	Same as V1.	15 kc oscillator/print driver.
V202	x	Same as V102.	Phasing amplifier/remodulator.
V203	Sig C: 2J2D21 Std Navy: N16-T-52421	ELECTRON TUBE: gas tetrode; thyratron; general purpose; RCA; JAN Type No. 2D21.	Phase pulse amplifier.
V301	x	Same as V1.	Amplifier.

TABLE 8–4. TABLE OF REPLACEABLE PARTS—Cont.

REF. DESIG.	STOCK NUMBER: SIGNAL CORPS, STANDARD NAVY, AIR FORCE	NAME AND DESCRIPTION	LOCATING FUNCTION
V302	Sig C: 2J6AG7 Std Navy: N16-T-56177	ELECTRON TUBE: pentode; power amplifier; general purpose; RCA; JAN Type No. 6AG7.	Limiter.
W1	Sig C: 3E7350.1-108.01 Std Navy: N17-C-48300-6176*	CABLE ASSY, POWER, ELECTRICAL: 3-conductor, stranded, No. 18 AWG, rubber ins; 0.330 in. dia rubber jacket; over-all lgth 9 ft, excluding terminations; one end terminated w/Harvey Hubbell No. 7484 female connector; other end terminated in molded rubber male plug connector and 4-in. grounding conductor with stud; general purpose; Times Facsimile Corp, part/dwg No. 45C-00-00-10.	Power cord.
W2	Std Navy: N17-C-48691-7001	CABLE ASSEMBLY, SPECIAL PURPOSE, ELECTRICAL: conductor details: 3 stranded AWG No. 20 conductors, black cotton braid over free stripping thermoplastic insulation w/black moisture and flame retardant lacquer over outer braid and fungus treated per JAN-C-173, 2 stranded AWG No. 18 conductors, rubber insulated; outer jacket Hyflex black tubing per MIL-I-631A type F grade A form U; tinned copper spiral shield w/cotton overbraid lacquered around ea of 2 AWG No. 20 conductors; approx o/a lgth 28 in.; 5 Amer Radio & Hardware No. TM11 spade lugs on first end (9/16 in. C to C of lugs), 1 Harvey Hubbell Twist Lock connector No. 7484 and 3 Walso-Electronic Hardware phone tips No. 2725-99 on other end; 2 branches 3¾ in. from tip of twist lock connector; conductor stranding: 7 AWG No. 28 strands in AWG No. 20 conductors, 41 AWG No. 34 strands in AWG No. 18 conductors; Times Facsimile Corp, part/dwg No. 40C-00-00-10.	Connection between chassis and cabinet.
XC5 through XC8 incl	Std Navy: N16-S-63515-4156	SOCKET, ELECTRON TUBE: 8 beryllium copper hot-tin dipped contacts; round ceramic body; over-all dim. excluding term.: 1¾ in. lg by 1¼ in. wd by ½ in. thick; mtg data: 1⅛ in. dia chassis hole required, one piece saddle with two 0.156 in. dia mtg holes spaced 1½ in. C to C; general purpose; Ucinite No. '115001-1B; JAN Spec No. S-28A; Times Facsimile Corp, part/dwg No. 34-00-92-00.	Sockets for C5 through C8 incl.
XE8	Std Navy: N17-L-76902-2564*	LAMPHOLDER: single holder, accommodate miniature bayonet lamp base; 220 v max; over-all dim. incl term.: 2½ in. lg by 13/16 in. dia; Dialco catalog No. 81408-117; Times Facsimile Corp, part/dwg No. 41-00-00-11.	Holder for E8.
XE9	x	Same as XE8.	Holder for E9.
XV1 through XV6 incl	x	Same as XC5.	Sockets for V1 through V6 incl.

XV7	Std Navy: N16-S-60852-2111	SOCKET, ELECTRON TUBE: 4 phosphor-bronze cadmium plated contacts; round, low-loss, mica-filled, bakelite body; over-all dim. excluding term.: 1⅞ in. lg by 1$^{9}/_{32}$ in. wd by $^{7}/_{16}$ in. h; mtg data: molded-in plate, mtg dim.: 1⅛ in. dia chassis hole required, two $^{5}/_{32}$ in. dia mtg holes spaced 1½ in. C to C; general purpose: Amphenol No. 77M1P-4TM; Times Facsimile Corp, part/dwg No. 90-15-20-00.	Power cord.
XV101 through XV103 incl	x	Same as XC5.	Sockets for V101, V102, V103.
XV201, XV202	x	Same as XC5.	Sockets for V201, V202.
XV203	Std Navy: N16-S-62603-6676	SOCKET, ELECTRON TUBE: 7 contacts, beryllium copper, silver plated; miniature; metal shock shield incl; center shield incl; Eby catalog No. 7676; Times Facsimile Corp, part/dwg No. 34-00-43-00.	Socket for V203.
XV301, XV302	x	Same as XC5.	Sockets for V301, V302.
Z1	Std Navy: N16-F-44027-4616	FILTER, LOW PASS: cut-off frequency 900 cps; impedance: 25,000 ohms input, 25,000 ohms output; over-all dim. 2$^{11}/_{16}$ in. by 1½ in. by 1$^{5}/_{16}$ in.; rectangular metal case; two No. 6-32 mtg studs 1$^{15}/_{32}$ in. apart; three solder lug term.; HS; general purpose; Times Facsimile Corp, part/dwg No. 41B-11-07-00.	Carrier elimination.
Z2	Std Navy: N17-S-50967-6969	SUPPRESSOR, ELECTRICAL NOISE: 2 inductances, 8 uh to 1 mh ea; 2 capacitors, 2 mf, 200 v dc working ea; 2 capacitors 1 mf, 200 v dc working ea; 3 amp dc or ac current rating; metal; 3¼ in. lg, 2$^{1}/_{32}$ in. w, 1 in. high; screw mounted, 2 mtg ears ea w/one $^{3}/_{16}$ in. dia mtg hole 2⅜ in. apart; 4 solder lug terminals; shock & vibration proof; Hopkins Engineering Co. part no. HE-1-3115; TFC part/dwg no. 41C-00-00-85.	Conducted noise suppressor.
Z-201	Std Navy: N16-N-48901-1029	NETWORK, PHASE SHIFTING: used in Colpitts oscillator; causes 180 deg phase shift at 14-18 kc; three solder lug term.: over-all dim. 2½ in. by 1$^{21}/_{32}$ in. by 1 in.; two $^{5}/_{32}$ in. dia mtg holes spaced 2⅛ in. C to C; HS metal case; Times Facsimile Corp, part/dwg No 41B-11-04-00B.	15 kc oscillator tank.

* Not furnished as a maintenance part. If failure occurs, do not request replacement unless the item cannot be repaired or fabricated.

TABLE 8–5. MAINTENANCE PARTS KIT

REF. DESIG.	ITEM	QUANTITY PER SET	REF. DESIG.	ITEM	QUANTITY PER SET
C 5	CAPACITOR, FIXED, ELECTROLYTIC	1	O 426	SPRING	2
C 8	CAPACITOR, FIXED, ELECTROLYTIC	1	O 437	GEAR, WORM	1
			O 438	RETAINER, MECHANICAL	6
CR 1	RECTIFIER, METALLIC	2	O 441	RETAINER, MECHANICAL	2
			O 442	RETAINER, MECHANICAL	10
E 403	ELECTROMAGNETIC ACTUATOR	1	O 447	RETAINER, MECHANICAL	22
E 404	WINDING, MOTOR FIELD	3	O 458	RETAINER, MECHANICAL	2
E 405	WINDING, MOTOR FIELD	3	O 460	HOLDER, STYLUS	1
E 406	ELECTROMAGNETIC ACTUATOR	1	O 462	GUIDE, PAPER	1
			O 463	COUPLING SECTION	1
H 401	PIN	1	O 464	DRIVE SUBASSEMBLY	1
H 412	SCREW, DOWEL	1	O 468	NUT, HALF	1
J 1	INSERT, ELECTRICAL CONNECTOR	1	P 1	INSERT, ELECTRICAL CONNECTOR	2
K 1	RELAY, ARMATURE	1	R 38	RESISTOR, VARIABLE	1
K 2	RELAY, ARMATURE	1	R 312	RESISTOR, VARIABLE	1
L 201	REACTOR, AUDIO	1	S 1	SWITCH, ROTARY	1
			S 2	SWITCH, PUSH	1
O 402	BEARING, BALL	1	S 4	SWITCH, ROTARY	1
O 404	BEARING, BALL	1			
O 409	BEARING, BALL	1	T 2	TRANSFORMER, AF	1
O 412	BEARING, BALL	1	T 3	TRANSFORMER, AF	1
O 415	BEARING, BALL	1	T 4	TRANSFORMER, AF	1
O 417	SPRING	2	T 101	TRANSFORMER, AF	1
O 419	SPRING	2			
O 420	SPRING	1	V 6	RESISTOR, THERMAL	1
O 421	SPRING	2	V 7	RESISTOR, THERMAL	1
O 422	SPRING	2			
O 423	SPRING	2	Z 1	FILTER, LOW PASS	1
O 424	SPRING	2	Z 201	NETWORK, PHASE SHIFTING	1
O 425	SPRING	2			

TABLE 8-6. CROSS REFERENCE PARTS LIST

JAN (OR AWS) DESIGNATION	KEY SYMBOL
CM20A511J	C 104
CM35B222K	C 4
CM45A102K	C 14
CM50A512J	C 11
CN35A103K	C 1
CP25A1EF104M	C 305
CP25A1EF503M	C 13
CP53B1EF205V	C 10
CP53B1EF504V	C 207
RC20BF101K	R 105
RC20BF102K	R 39
RC20BF103K	R 31
RC20BF104K	R 42
RC20BF105K	R 35
RC20BF113J	R 19
RC20BF124J	R 3
RC20BF134J	R 5
RC20BF153K	R 211
RC20BF184J	R 15
RC20BF185K	R 213
RC20BF222K	R 104
RC20BF223K	R 33
RC20BF273J	R 11
RC20BF274K	R 47
RC20BF394K	R 215
RC20BF470K	R 103
RC20BF471K	R 43
RC20BF472K	R 216
RC20BF473K	R 45
RC20BF474J	R 9
RC20BF474K	R 36
RC20BF563J	R 7
RC20BF564J	R 13
RC20BF623J	R 1
RC20BF682J	R 55
RC30BF101J	R 34
RC30BF472K	R 32
RC30BF473K	R 40
RC40BF103K	R 30
RC40BF154K	R 28
RC40BF222K	R 401
RC40BF683K	R 203
RW32G122	R 25
RW32G250	R 27
RW32G501	R 23
TSB8T102	XC 5
1635	V 2
2D21	V 203
6AG7	V 302
6SL7GT	V 102
6SN7	V 1
0A3	V 5

ARMY-NAVY TYPE	KEY SYMBOL
AN-3102-20-1S	J5
AN-3102-20-7S	J6

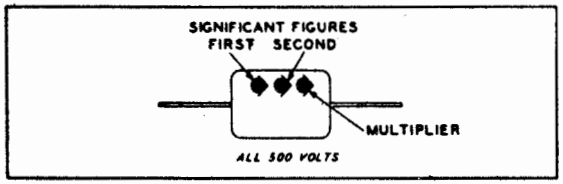
NAVY TYPE	KEY SYMBOL
63360-102	R39
63360-103	R30
63360-104	R42
63360-105	R35
63355-113	R19
63355-124	R3
63355-134	R5
63360-153	R211
63355-184	R15
63360-185	R213
63360-222	R103
63360-223	R33
63355-273	R11
63360-274	R101
63360-394	R215
63360-470	R105
63360-472	R216
63360-473	R45
63355-474	R9
63360-474	R36
63355-563	R7
63355-564	R13
63355-623	R1
63291-101	R34
63288-472	R32
63288-473	R40
63474-103	R30
63474-154	R28
43474-222	R401
63474-683	R203

SIGNAL CORP. STOCK NUMBER	KEY SYMBOL
3RC20BF101K	R105
3RC20BF102K	R39
3RC20BF103K	R30
3RC20BF104K	R42
3RC20BF105K	R35
3RC20BF113J	R19
3RC20BF124J	R3
3RC20BF134J	R5
3RC20BF153K	R211
3RC20BF183J	R15
3RC20BF185K	R213
3RC20BF222K	R104
3RC20BF223K	R33
3RC20BF273J	R11
3RC20BF274K	R47
3RC20BF394K	R215
3RC20BF470K	R103
3RC20BF471K	R43
3RC20BF472K	R216
3RC20BF473K	R45
3RC20BF474J	R9
3RC20BF474K	R36
3RC20BF563J	R7
3RC20BF564J	R13
3RC20BF623J	R1
3RC20BF682J	R55
3RC30BF101J	R34
3RC30BF472K	R32
3RC30BF473K	R40
3RC40BF103K	R30
3RC40BF154K	R28
3RC40BF222K	R401
3RC40BF683K	R203

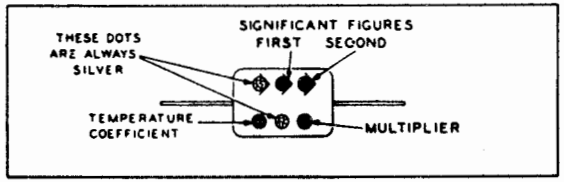
TABLE 8-7. APPLICABLE COLOR CODES AND MISCELLANEOUS DATA

CAPACITOR COLOR CODES

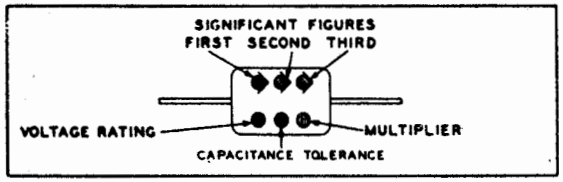
RMA 3-DOT COLOR CODE FOR MICA-DIELECTRIC CAPACITORS



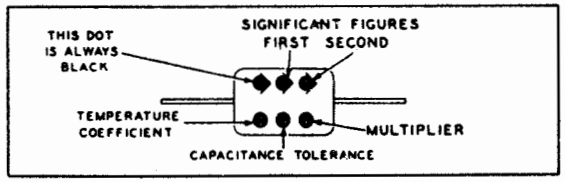
JAN 6-DOT COLOR CODE FOR PAPER-DIELECTRIC CAPACITORS



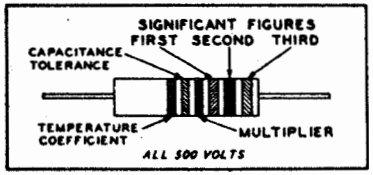
RMA 6-DOT COLOR CODE FOR MICA-DIELECTRIC CAPACITORS



JAN 6-DOT COLOR CODE FOR MICA-DIELECTRIC CAPACITORS

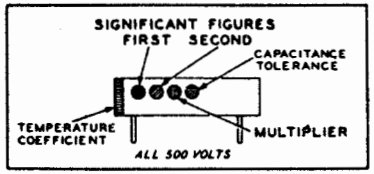


RMA COLOR CODE FOR TUBULAR CERAMIC-DIELECTRIC CAPACITORS

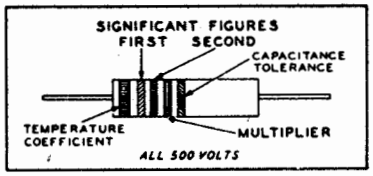


JAN COLOR CODE FOR FIXED CERAMIC-DIELECTRIC CAPACITORS

RADIAL TYPE NON-INSULATED



AXIAL TYPE INSULATED



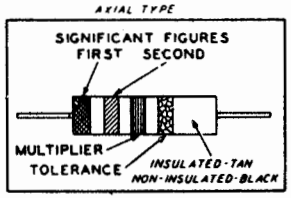
RMA: RADIO MANUFACTURERS ASSOCIATION
JAN: JOINT ARMY-NAVY

RESISTORS		CAPACITORS						
				MULTIPLIER				
TOLERANCE	MULTIPLIER	SIGNIFICANT FIGURE	COLOR	RMA MICA AND CERAMIC-DIELECTRIC	JAN MICA AND PAPER-DIELECTRIC	JAN CERAMIC DIELECTRIC	VOLTAGE RATING	TEMPERATURE COEFFICIENT
	1	0	BLACK	1	1	1		A
	10	1	BROWN	10	10	10	100	B
	100	2	RED	100	100	100	200	C
	1000	3	ORANGE	1000	1000	1000	300	D
	10000	4	YELLOW	10000			400	E
	100000	5	GREEN	100000			500	F
	1000000	6	BLUE	1000000			600	G
	10000000	7	VIOLET	10000000			700	
	100000000	8	GRAY	100000000		0.01	800	
	1000000000	9	WHITE	1000000000		0.1	900	
5	0.1		GOLD	0.1	0.1		1000	
10	0.01		SILVER	0.01	0.01		2000	
20			NO COLOR				500	

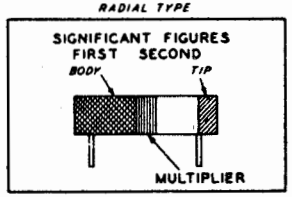
RESISTOR COLOR CODES

RMA COLOR CODE FOR FIXED COMPOSITION RESISTORS

AXIAL TYPE

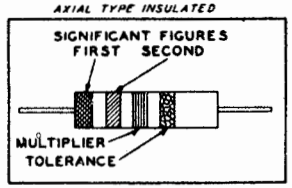


RADIAL TYPE



JAN COLOR CODE FOR FIXED COMPOSITION RESISTORS

AXIAL TYPE INSULATED



RADIAL TYPE NON-INSULATED

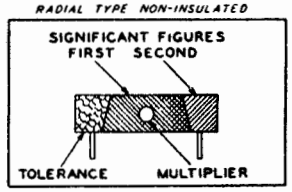


TABLE 8–8. LIST OF MANUFACTURERS

PREFIX	NAME	ADDRESS
	Alex Mogull Co., Inc.	50 West Broadway New York 7, N. Y.
CPH	American Phenolic Corp.	1830 South 54th Avenue Chicago, Ill.
CNH	American Radio & H'dware Co.	152 McQueston Parkway South Mount Vernon, N. Y.
CAGK	Amperite Company, Inc.	561 Broadway New York 12, N. Y.
CHU	Harvey Hubbell, Inc.	447 Concord Avenue Bridgeport, Conn.
	Waldes Koh-I-Noor, Inc.	4710 Austel Place Long Island City 1, N. Y.
CFA	Bussman Mfg. Co.	53 Park Place New York 7, N. Y.
	Camloc Fastener Corp.	420 Lexington Avenue New York 17, N. Y.
	Centralab, Div. of Globe Union Co., Inc.	900 East Keefe Avenue Milwaukee, Wisc.
CMC	Clarostat Mfg. Co., Inc.	Washington Street Dover, New Hampshire
COI	Cords Ltd.	121 Dodge Avenue De Kalb, Illinois
CRY	C. P. Clare & Co.	4719 W. Sunnyside Avenue Chicago 30, Illinois
CAYZ	Dial Light Corp. of America	900 Broadway New York 3, N. Y.
	Everlock, Thompson-Brenner & Co.	1640 W. Hubbard Street Chicago, Illinois
CF7	Federal Telephone & Radio Co.	100 Kingsland Road Clifton, N. J.
CAWS	Gavitt Mfg. Co.	Brookfield, Mass.
	General Cement Mfg. Co.	Rockford, Illinois
CG	General Electric Co.	200 Main Avenue Clifton, New Jersey
	Hopkins Engineering Co.	2082 Lincoln Avenue Altadena, Calif.
CEB	Hugh Eby Inc.	4700 Stenton Avenue Philadelphia 44, Pa.
CLF	Littelfuse, Inc.	1865 Miner Street Des Plaines, Illinois
	Metal Etching	83-00 Atlantic Avenue Ozone Park, L. I., N. Y.
	National Products, Inc.	61 Sherman Street Malden 42, Mass.
CRC	R.C.A.	Harrison, New Jersey
CSF	Sprague Specialties Co.	Beaver Street North Adams, Mass.
CRS	Sylvania Electric Products, Inc.	1740 Broadway New York 19, N. Y.
	Tinnerman Products Co.	75 Roseville Avenue Newark, New Jersey
	T. R. Brawley Felt Co., Inc.	275 20th Street Brooklyn, New York
	The Ucinite Co.	Newtonville 60, Mass.
CAPB	U. S. Instrument Corp.	409 Broad Street Summit, New Jersey
CV	Western Electric	30 Church Street New York 7, N. Y.
	Tobe Deutschmann Corp.	921 Providence Highway Norwood, Mass.

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